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Volume 3 JANUARY, 1939 Number 4

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THE INTERNATIONAL NICKEL COMPANY, INC.
73 WALL STREET NEW YORK, N. Y.

PRODUCTS finishing

CINCINNATI, OHIO VOL. 3, NO. 4

JANUARY, 1939

Interesting Methods Used in Silverware Manufacture

The most interesting and important steps in the plating of hollow and flat silverware are described in this article.

By FRED W. VOGEL

MAKING a quality product available to the greatest number of people by reducing costs through careful organization and close control have been important factors both in the manufacturing and merchandising departments of the International Silver Company, Meriden, Conn. Equipment of both standard and special design have been co-ordinated to meet the special needs of this—one of the largest and oldest firms in the United States engaged in the manufacture of both flat and hollow silverware.

Two types of buffing machines employing unusual design are used in the buffing department for finishing workpieces prior to plating; one is designed

(Headpiece)—Sample pieces of the fine silver hollow-ware manufactured and plated by the International Silver Company. These pieces are rendered in the First Love pattern of 1847 Roger Bros. quality.

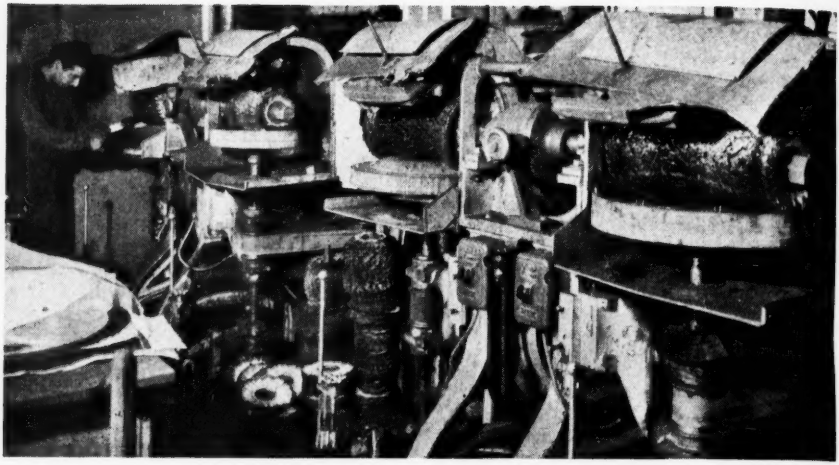

Fig. 1—Trays, platters, and other flat pieces up to 24 inches in diameter are buffed on machines such as these prior to plating.

for finishing round pieces and the other for oval-shaped pieces. During the finishing operation, the workpieces are located on jigs which consist either of wooden or metal blocks that have been shaped to fit the contour of the pieces being finished. Workpieces such as platters, trays, and so on when located on the jigs of the buffing machine are revolved in a circular direction in a horizontal plane while at the same time the buffing wheel revolves against the work in a vertical plane.

Figure 1 shows a view of two of the double-spindle automatic buffing machines which are designed to buff round pieces up to 24 inches in diameter. Round workpieces are placed on the jigs of the work-holding fixture and are revolved in a circular direction at a speed which is relative to the speed of the buffing wheel. The

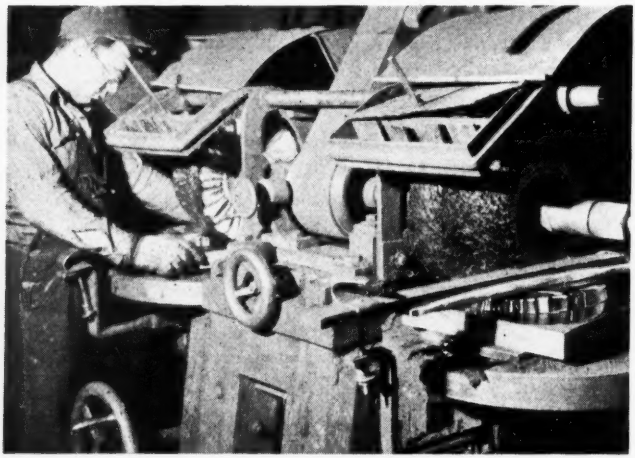

Fig. 2—The automatic reciprocating spindle on this buffing machine permits the buffing of oval-shaped workpieces.

Fig. 3—Hand buffing into recessed portions of chalices, vases, and so on is an easy task when the long-spindle buffing lathes shown in the illustration are used.

buffing wheels used are 6 inches in diameter and can be made with a face up to 24 inches, depending upon the diameter of the work being buffed. The double-spindle type of buffing machine arrangement such as shown here is evidence of good layout, since by this method one set of spindles can be operated while the spindles on the other machine are being loaded.

Illustrated in Fig. 2 is a buffing unit which was designed for buffing oval-shaped workpieces. An adjustable vertical spindle drive of the work-holding fixture on this machine provides for a reciprocating motion of the work in a horizontal plane beneath the buffing wheel which is located in a vertical plane and travels at the rate of 2,100 r.p.m. The buffing wheels used on the oval-shaped pieces are 8 inches in di-

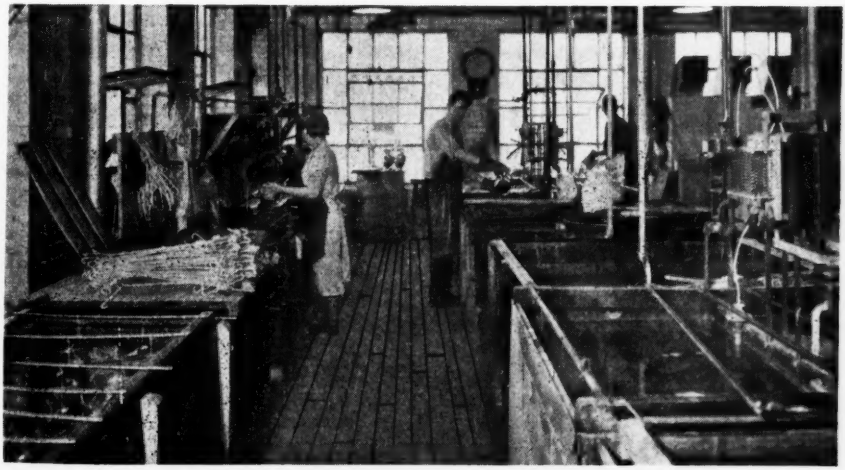

Fig. 4—Absolute cleanliness of work is assured by the use of alkaline cleaner baths which are located at the end of the plating department shown in this illustration.

Fig. 5—Each of the tanks shown in this illustration has a capacity of 2,000 gallons of silver solution each.

ameter and approximately 6 inches across the face.

Individual outlet ducts of a centrally located down-draft dust collecting system are attached to the buffing machines near each buffing head; thus, when each machine is operating at full production, the buffing department is kept clean and free from dust.

Due to the many unusual shapes of workpieces such as vases, chalices, and so on, a large amount of hand buffing is necessary. Fig. 3 shows a view of the department in which the hand buffing operations are performed, a group of 24 long-spindle buffing lathes being provided for this work. The spindle speed of each of these units is 3,500 r.p.m. One section of this department is used for coloring workpieces after plating.

Two views of the hollow ware silver plating department are shown in Figs. 4 and 5. The first operation of the plating sequence is a caustic soda electrolytic cleaning bath which requires from one to one and one-half minutes. A cold water rinse follows and then the workpieces are brushed and machine buffed with a very fine grade of pumice. The lathes, which are equipped with 4-inch brushes located on 18-inch shafts, are shown at the left in illustration Fig. 4.

Another cold water rinse and a second electrolytic caustic soda cleaner using 40 to 50 amperes per square foot follows. Before the work is placed in a silver strike, each piece is again carefully rinsed and is then individually racked and hung in the silver strike tank. This solution is made up so that it has a high copper and silver content. The purpose of this strike or flash is to coat the article all over with a thin coating of silver at a high current density and thus provide a bond between the base metal and the silver plate that follows.

A general view of the hollow silver-

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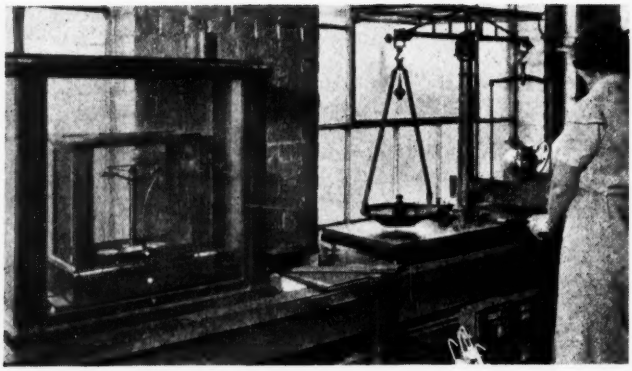

Fig. 6 — Illustration showing the balances used to check by weight the deposition of silver from the plating baths.

ware plating department is shown in Fig. 5. A pitch compound is used as a lining for the tanks in this department, each of which is of 2,000 gallons capacity. Cotton baffle filter screens are used to shield the anodes. A sufficient amount of space is provided between the anodes and the screens so that the work can be agitated backwards and forwards at the rate of 42 strokes per minute without any difficulty.

A Troemner assay balance as shown in Fig. 6 is used to weigh work before and after plating to determine the number of pennyweights of silver weight deposited. An accurate check of the work being processed is made at regular intervals and compared with the standard specifications that have been set. The balance shown at the left in the illustration Fig. 6 is used to weigh small articles that have been gold plated.

Figure 7 shows a view of the department where workpieces are plated with metals such as bronze, nickel, and gold. The same procedure of cleaning as with the flatware is followed in the finishing sequence of the plating of these metals. The gold solutions are kept in two pitch lined tanks, each having a capacity of 350 gallons. Gold plating is used primarily on trophies, candelabras, vases and chalices that have been designed and fabricated by the International Silver Company.

Silver plating of flatware such as cutlery is carried on in the automatic Hanson-Van Winkle-Munning plating unit shown in Fig. 8. After the workpieces have been racked in a special spring clip racking device, they are passed automatically into the cleaning and striking tanks. The Magnus cleaner which is used in the alkaline cleaner tanks of the automatic

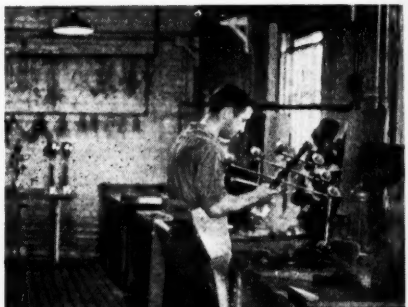

Fig. 7—One section of the department in which articles such as candelabras, chalices, and so on are gold plated.

unit aids in providing a chemically clean surface for the work prior to plating. A spray and still rinse follow the alkaline cleaner and then the workpieces are passed into a second cleaner. A spray and still rinse as pass through the silver solution. The silver metal in the solution plates out at the rate of 22 to 24 pennyweight per day. The plating cycle, which consists of a complete rotation of the cluster-holding fixture, requires ap-

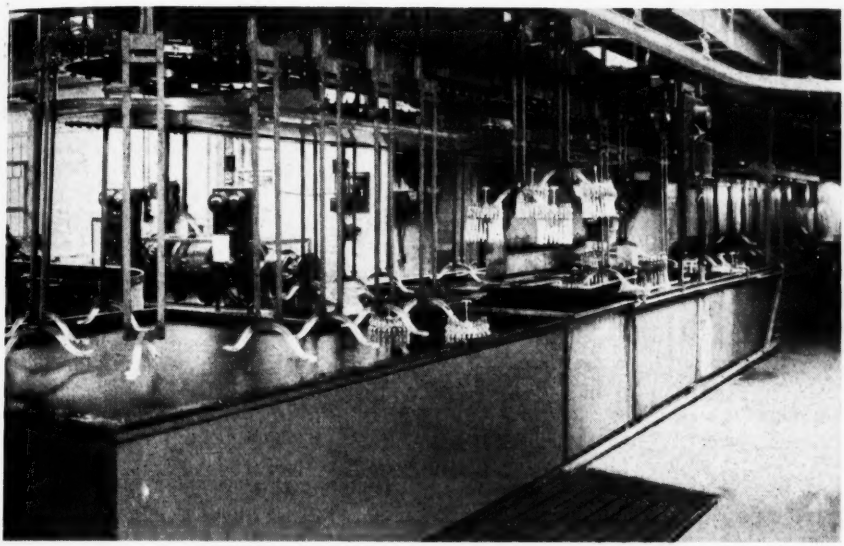

Fig. 8—View of the completely automatic Hanson-Van Winkle-Munning silver plating unit.

before is used, followed by a cyanide dip, after which the pieces are given a silver strike for 30 seconds before they are carried into the silver plating tank. Following the silver plating cycle, the pieces are again passed through two rinses.

Circular tanks such as the one shown in Fig. 9, each of which contains 300 gallons of solution, are used for a part of the production plating of silver cutlery. The tank shown is one of 24 located in this department. The workpieces are racked in clusters by means of a spring clip fastening device and the clusters are then hung on a holding fixture of the plating unit which revolves the clusters as they proximately three-quarters of an hour.

Figure 10 shows a unique application of sectional plating equipment in operation. Sectional plating or spot plating is required on those sections of silver plated ware which are subjected to the most use and wear in order to apply an extra heavy coating of silver at this point. The bottom of the bowl-shaped portion of a spoon is such a section.

The unit shown in the illustration consists primarily of a tank in which rows of pipes with small holes drilled in them have been placed on the bottom. The pieces to be plated are placed across racks consisting of L-shaped bars which are adjustable to

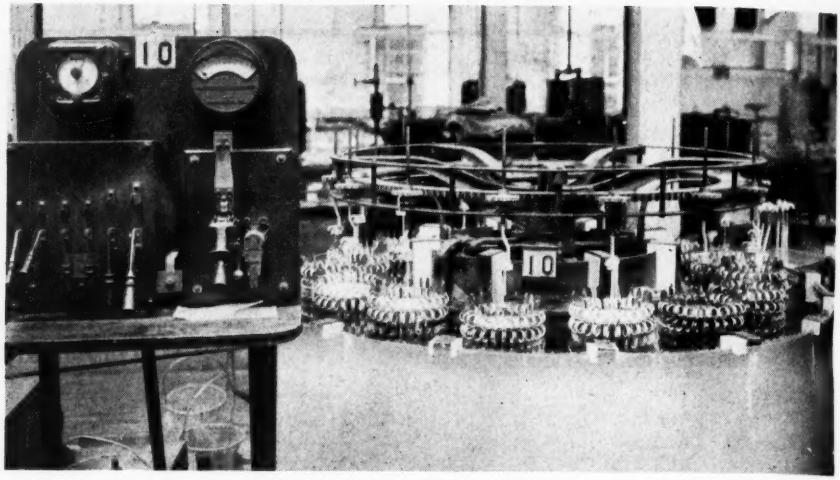

Fig. 9—One of the 24 rotary plating units located in the silver flatware plating department.

accommodate various lengths of spoons. The silver solution in the tank is pumped through the pipes by means of a pump which is located at one end of the tank. Each sectional plating unit is equipped in the same manner; thus each tank in this department operates as a separate plating unit.

The silver solution is pumped through the pipes with sufficient force so that, as it emanates from the small holes in the pipes, a small bubble is formed over each hole at the surface of the solution. The workpiece to be sectional plated is placed on the L-shaped holding racks at the exact height required so that the bubbling solution hits only the bottom of the bowl. In this manner, a heavier coating is applied to that portion of the

Fig. 10—Spot or sectional plating is done in shallow tanks of the type shown here. Note carefully the location of the workpieces and also the bubbling solution.

spoon which will be subjected to the most wear.

The pipes which lie on the bottom of the shallow sectional plating tanks aid in keeping the solution agitated while in operation. Small anodes can be used, since they can be laid in baskets which are located at the bottom of the tank. Three rows of 36 small spoons each can be plated at the same time when placed on the racks as shown in the illustration.

The equipment and methods described in the foregoing article have been the result of three-fourths of a century of experience in the plating of fine silverware.

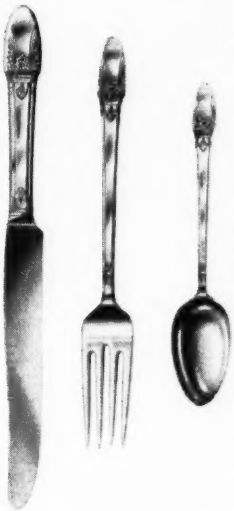

Illustration showing several pieces of silver flatware manufactured by the International Silver Company in the First Love pattern of 1847 Rogers Bros. quality.

Modern Plating of Die Castings Described in Oakite Magazine. Modern methods of cleaning and electroplating zinc alloy die castings are interestingly described in a four-page feature article appearing in the May-June issue of Oakite News Service, a magazine published by Oakite Products, Inc., 20 Thames St., New York, N. Y., manufacturers of cleaning materials for the metal-working industry.

Practical formulas for plating die castings with copper, nickel, chromium or cadmium deposits are fully outlined. A brief explanation of a recently developed and patented process for thoroughly removing grease and dirt from articles prior to the alkaline bath is also given.

Copies of this article are available on request. Future issues of the Oakite News Service will be gladly mailed to anyone wishing to receive the publication regularly without obligation. Write to Oakite Products, Inc., 20 Thames St., New York, New York.

"Neville Resins." This is the title of a 64-page booklet in which distinctly new types of resins which have been produced to meet industrial demands for thermoplastics for modern applications by The Neville Company, Neville Island, Pittsburgh, Pa., are described. The 64 pages present in detail the properties, specifications and uses of the various types and classes of thermoplastic resins that are offered for general industrial use. Copy of this booklet will be sent free upon request.

"Lightnin Portable Mixers." This is the title of a very attractive 8-page catalog describing and illustrating "Lightnin" Portable Mixers which are manufactured by Mixing Equipment Company, Inc., 1087 Garson Ave., Rochester, N. Y. One section of this catalog is devoted to gear drive models and another to the direct drive models. Specification tables are included in which is listed full information regarding the mixers.

Ten types of impellers are also illustrated.

Copy free upon request.

Dahlstrom Metal Mouldings and Shapes. Dahlstrom Metallic Door Co., Jamestown, N. Y., has issued a catalog of interest to manufacturers who fabricate or assemble sheet metal parts or products. The catalog contains 167 page profusely illustrated with actual-size section drawings of the innumerable shapes produced by this company from practically all of the commonly-used metals. The simplified indexing and arrangement by which the catalog is sectionalized under logical classifications will appeal to busy plant executives.

A copy of the book may be obtained by any mechanical executive who will address a request on his business letterhead.

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Abrasive Finishing of Stainless Steel

The procedure to be followed for best results is explained in simple terms by the author.

By Bartlett West

SINCE the introduction of corrosion resisting or stainless steels and monel metal, the uses for them have become varied. Products produced in these metals have been received by industry and the public with great popularity.

One of the important characteristics of corrosion steels which has contributed greatly to their popularity is that that they retain their polish for indefinite periods of time. Dust and grime which settle on the surface can easily be cleaned by washing with soap and water, thus restoring the metal to its original lustre.

The widespread use of stainless steels by industry has raised the question of how best to produce a finish on a fabricated or drawn article. The method which is outlined is being used successfully with slight variances. The amount of grinding or polishing necessary to produce a desired finish naturally depends upon the surface finish of the sheets used. Most manufacturers supply sheets in six to eight finishes, such as:

Hot rolled (annealed pickled), full finish (bright cold rolled), full finished (dull cold rolled), standard commercial polish, commercial polish (Tampico brushed), high lustre polish, and mirror finish.

Probably the most common sheet is the standard commercial ground on one or both sides. Because of its low grade finish, the hot rolled, pickled sheet requires the most grinding and polishing to bring it to a high lustre. It is, therefore, necessary to start by using a soft grease abrasive set-up wheel, or abrasive polishing belt in grits of 80, 120, 150, 180, 200 or 240 in successive operations. The grain used should be aluminum oxide. A grease of high melting point should be used, since low melting point greases

Diameter of Wheel	Surface feet per minute										
	6000	6500	7000	7500	8000	8500	9000	9500	10000	11000	12000
8	2865	3103	3343	3581	3820	4058	4297	4536	4775	5252	5729
10	2292	2482	2674	2865	3056	3247	3439	3629	3820	4202	4584
12	1910	2069	2228	2387	2546	2706	2865	3024	3183	3501	3820
14	1637	1773	1910	2046	2183	2319	2455	2592	2728	3001	3274
16	1432	1552	1671	1790	1910	2029	2148	2268	2387	2626	2865

Fig. 1—Chart showing the number of surface feet polished or buffed per minute when the diameter of the polishing or buffing wheel and the revolutions per minute of the wheel are known.

do not hold the grinding compound. It is for this reason that a stearic base grease is recommended.

Care must be taken to see that all marks and scratches from previous grindings be removed before starting with a finer grinding. When the article is to be formed or drawn in one or two operations, and after annealing and pickling takes place, these operations may be performed after using 200 or 240 abrasive. If necessary, another grinding with No. 240 grain can follow the final drawing.

If a satin finish is desired, a Tampico brushing will produce a good finish. Buffing for a bright polish will be obtained by the use of green chrome. Red rouge or polish containing iron must never be used. The grinding and polishing procedure should be carried out by using the least possible pressure of the work against the wheel.

It is well to note that the better finish of the sheet as it comes from the mill, the less operations are necessary to produce a desired finish.

Wheel and belt speeds are very important and should be checked carefully from time to time. Polishing speeds from 6,000 to 8,000 surface feet per minute should be maintained where a satin or matte finish is desired. A buffing speed of about 8,500 to 12,000 surface feet per minute is recommended for obtaining a bright finish.

Welding is the accepted method for fabricating, and is widely used in the manufacturing of tanks, restaurant and hospital equipment, and so on, and it therefore becomes necessary to grind the welded area to the same surface appearance as the polished finish.

Depending upon the job to be done, it is sometimes necessary to start with an aluminum oxide wheel 30 or 36 grit in the hard grades, proceeding

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to 60, 120 and 180 grease wheels. Where the piece being handled is irregular or does not lend itself to easy handling, a portable sander, or flexible shaft unit, using aluminum oxide fibre back discs, will work very satisfactorily. Discs in grits of 24, 36, 60, 80, 120 and finishing with buff, if necessary, produce an excellent finish.

Where vitrified wheels are used, wheel speeds should not exceed 6,000 surface feet per minute. When machines exceeding this speed are used, they must be equipped with a resinoid, or rubber bonded wheel. These wheels will operate successfully at 9,000 surface feet per minute.

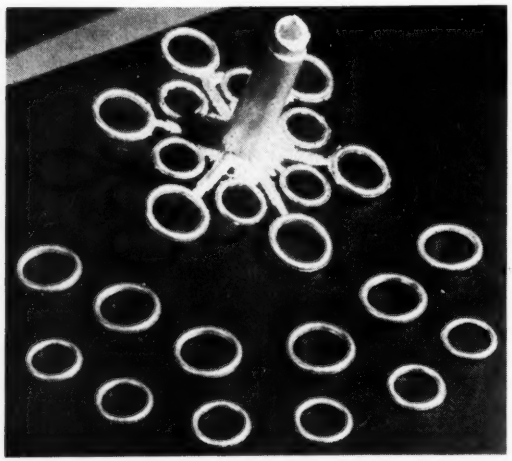
Much polishing is done by belt polishing machines, and the expanding type drum or wheel. In addition to special applications, the most common type of machines are the horizontal, vertical and centerless types, using cloth-backed belts of various sizes.

We shall not discuss the merits of the various machines on the market, but will deal briefly with the kinds of cloth backing used in the manufacture of abrasive belts used by these machines.

The aluminum oxide belt is widely used in metal finishing because of its ability to cut rapidly and remain cool. The cloth used is usually designated by the letter "X" and "X" drills, such as "XX" drills and jeans cloth. "X" cloth is used for heavy work on flat surfaces. For very heavy work "X" drills or "XX" drills are used. Where the abrasive cloth belt passes over relatively small pulleys, and where flexibility is desired, jeans cloth is used.

Various types of belt splices or joints are available, as well as the "No-Lap" type of belt in the smaller sizes. The "No-Lap" belt is becoming increasingly popular with polishers because there is no splice to cause a throb or bump as the belt passes over or below the piece being polished. They are available in sizes of ¼ in. x ½ in. to 36¼ in. x 4 in. for use on polishing wheels and small polishing sanders.

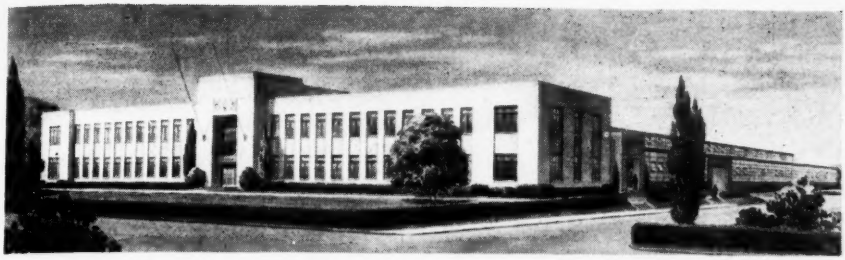
Each of these cloth abrasive belts has its own particular function and therefore, when the question of what kind is best suited for a particular job comes up, an experienced factory representative should be consulted. He can save much money, time and trouble by recommending the proper belt and kind of abrasive to use.



Barrel Burnished Die Cast Rings

The rings shown here are used in awning and drapery manufacture and have been barrel-burnished in order to obtain a smooth finish.

(Photo Courtesy The New Jersey Zinc Company)



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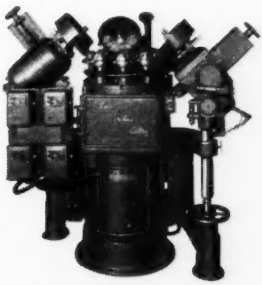

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Chipping Resistance of Enamels

The information contained in this article was presented at the Third Annual Porcelain Enamel Institute Forum.

By Dr. Paul L. Smith

Research Fellow, Porcelain Enamel Institute,
National Bureau of Standards, Washington, D. C.

FOR the past year, we have been breaking a lot of enamel ware at the bureau while working on a standard test for impact resistance. During this work on impact, it was realized that the question of chipping is much broader than just the impact test and so, under the direction of a committee from the industry, the work was broadened to include a study of the other kinds of chipping and the relations between the various kinds.

What we are after here is to find out what happens when a piece chips, where the crack starts and how it travels, and to answer questions such as the following: "Is there any part of the enamel finished metal workpiece that fails first consistently?"

With this information, we feel we will be in a much better position to know just what tests and how many tests are necessary to evaluate the chipping resistance of the various kinds of ware. Since chipping is a practical problem, the first thing of course, was to visit plants and talk to the men in charge to find out where chipping occurs in practice.

These practical observations were used to guide the laboratory work. In the field, chipping often occurs on complicated shapes where it is difficult to study the failures. One of the aims of this work was to produce the kinds of failures of importance commercially on simple shapes where they could be studied.

After discussing chipping with a number of men in the industry, it was found that the term "chipping" as used, refers to almost any failure in which a sizeable piece of enamel is removed from

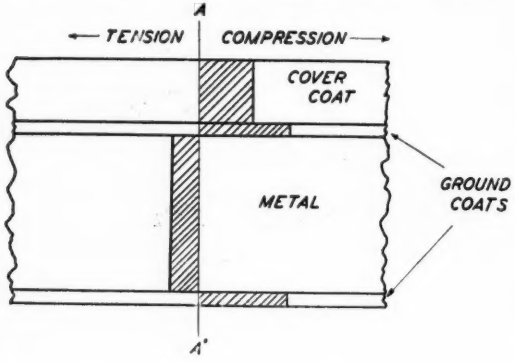

Fig. 1 — Drawing which shows a cross-section of a piece of enameled metal. (An example of stresses in Enamel-Metal Systems.)

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Type D Roto-Clone is designed for air volumes up to 20,000 c. f. m.
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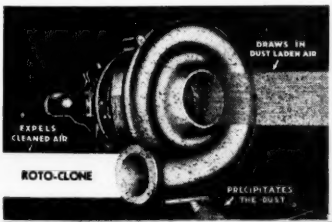

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the metal. Such a definition covers a wide variety of failures, as, for example, those due to bending in tension, such as occur in a strip

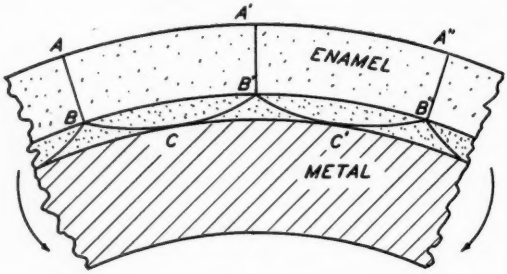


Fig. 2—A cross-section—cover coat, ground coat and metal, of a piece of enameled metal bent in the direction of the arrows. (An example of chipping by bending in tension.)

of enameled iron when the enamel is on the convex side; failures due to bending in compression, such as occur when the enamel is on the concave side of a bent strip, or on the edge of a flanged panel when the flange is bent outward. This definition will also include failures arising spontaneously, those due to twisting and those caused by local stresses such as occur around a screw hole or at a point of impact. Finally, it will include failures arising from any combination of the above sources.

Today, after brief mention of the principles which can be of use in a study of this kind, and a review of the stress conditions which exist in a piece of enameled iron before any external forces are applied, I wish to discuss possible mechanisms for two kinds of chipping.

First, let us consider the principles involved. Our knowledge of them is due to the work of Preston on glass, and the first one is that brittle materials, including glass and enamels, fail only in tension. That is, they have to be pulled apart. They do not fail by sliding, as metals do, and naturally they do not fail by being pushed together.

The second principle is that, as the crack travels in a brittle material, it tries to keep itself perpendicular to the direction of maximum tension.

So the question becomes, "Where and how do these tensions arise which are responsible for the chips?" Sometimes it is easy and sometimes it is much more difficult to answer this query. Before considering in detail two specific cases of chipping, it will help to review the stress conditions which exist in the ware before any external forces are applied. These, of course, are due to the difference in the thermal expansions of the iron and the enamel. As the piece cools the iron shrinks more than the enamel and squeezes the enamel together while the iron in turn is stretched by the enamel.

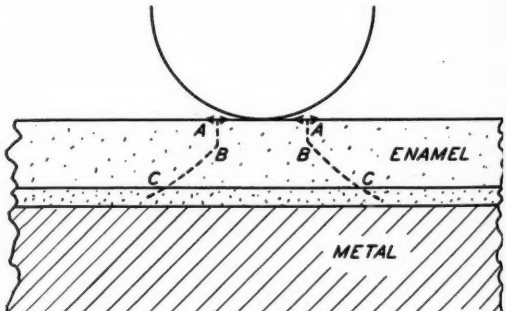
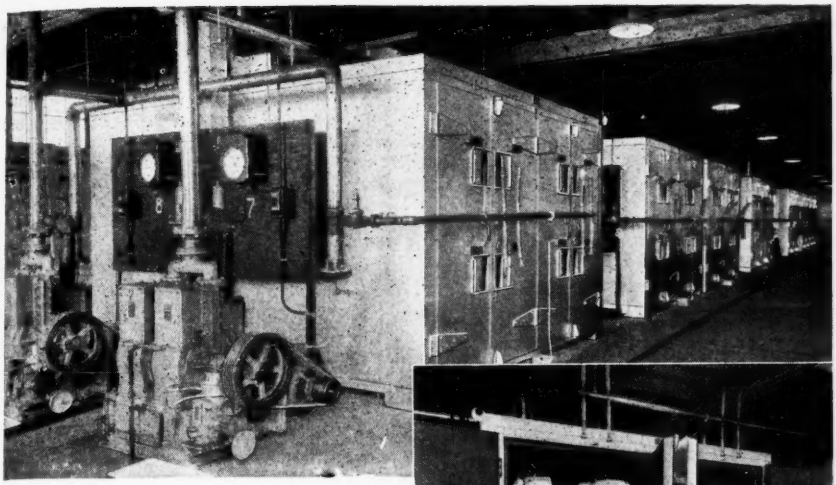


Fig. 3—Illustration showing a cross-section of enameled metal under an impact. (An example of early stage impact failure.)



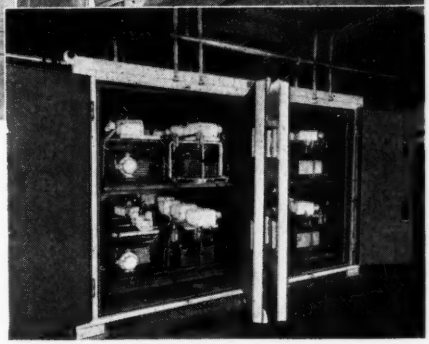


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Fig. 1 shows a cross-section of a piece of enameled metal. The relative thickness of the various layers is that which would be found in a piece of twenty-gage metal enameled with a ground coat of .003 in. thickness and two cover coats of .006 in. thickness each. Stresses are represented on the horizontal axis, compression to the right and tension to the left. These were calculated by assuming average elastic and thermal properties for the enamels and the iron. This picture applies to any situation where bending is prevented; for example, a flat strip with clamped ends, or an unbroken ring. In addition, any effects due to quenching are neglected here.

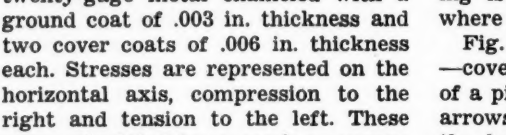

Fig. 4—Illustration showing the result of an impact to the enameled metal. (An example of later stage impact failure.)

It will be seen that the cover coat and the ground coat are in compression, the iron is in tension, and that the stress throughout any one layer is constant. Further, the ground coat is stressed more highly than the cover coat which is partly due to the higher softening point of the ground coat and partly to its smaller thickness.

One other point should be mentioned. We don't know much about the enamel-metal boundary, and this region may prove to be important in chipping. Since we don't know just what the layer is, and what its properties are, nothing can be said as to the stress conditions existing there.

If a flat strip is bent down, with the enamel on the convex side, the compression on the top layer will at first be decreased and, finally, the top layer moves into tension. As the bending is increased, a point is reached where the enamel will crack.

Fig. 2, again, shows a cross-section —cover coat, ground coat and metal, of a piece bent in the direction of the arrows. We will consider, first, that the bending has been such that the cracks have just started at the points "A," whose distance apart will be determined in part by the thickness of the enamel. Each crack goes down through the cover coat until it reaches the ground coat, where there is a slight hesitation because, as we saw in the previous diagram, the ground coat is in higher compression, and stress sufficient to break the cover coat will not quite break the ground coat. In that hesitation, there is a chance for the crack to fork and it does so at the border of the cover coat and ground coat.

Then the cracks change direction and slope off more toward a horizontal path. When forks from two adjacent cracks such as those starting at A and A' meet as at C, the piece A, B, C, A' will chip out and we have chipping due to bending in tension.

Certain data on the relation of thickness of the enamel to deflection required to chip the enamel in tension indicate that this chipping occurs at a fairly definite stress and that it is due to a well defined mechanism and not to an accidental twisting or any other chance happening.

In practical cases, a failure of this kind generally is accompanied by torsion which changes the direction of the cracks and puts in a compressive component which tends to throw the enamel off a little quicker, but does

not alter the fact that the crack starts at the surface and proceeds inwards.

If, instead of being bent in tension, a piece is bent with the enamel on the concave side, it will stand a lot more distortion without failure, and when it does fail, there is a shattering over the whole curved area. This kind of chipping is not of much commercial importance, but there is another kind of chipping in compression which is of commercial importance, and that is the kind I mentioned earlier, in which a curved piece, such as a flanged panel, is stressed so as to throw the enamel covering the corner, or edge, in compression, causing it to chip.

A study of this kind of chipping will be one of the immediate objectives of the work — to find out the conditions under which it occurs and how it occurs.

Turning now to the impact failures, we find that in this case we have two effects to consider: First, the effect of local forces right around the area of impact; and, second, the effect of the bending of the whole piece. These effects are not independent, and their relative importance will vary with the size and shape of the piece and the thickness of the metal and enamel.

Concerning the local forces, we know something of these from Hertz's work on elastic bodies in contact. The interesting point here is that the local forces are not entirely compressive but an important tension arises right outside of the area of contact.

In order to see how these two effects; that is, the effect of local forces and the effect of deflection, enter into the picture of impact, let's take a specific case of an impact failure on a piece where the surface is approximately spherical and the radius is fairly large; e. g. a mixing bowl.

Fig. 3, shows a cross-section of enameled metal. The curved line represents a sphere pressing on the piece, and the directions of the tensions above are represented by the arrows.

This crack opens up at point "A" and travels a short distance perpendicular to the surface. Then, the changing stress conditions cause the crack to change direction and slope off at "B" and finally it reaches the ground coat at "C" where it turns off nearly horizontally. So far, this behaviour is very similar to failures in glass which have been described by Preston.

Any time after this crack opens up at "A," the whole center "button" is free from the surrounding material, so that the impact forces are transferred to the bottom of the crack. When this crack works its way down where it is horizontal, the tensile stresses are acting in a perpendicular direction. What happens in this case depends on the adherence and thick-

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ness of the enamel coating.

If the enamel is very thin and the adherence is good, the whole piece will bend and we do not get chipping in the ordinary sense. We get only a pit at the point of impact. But, if the enamel is thick enough to resist bending, then the metal and part of the ground coat are literally torn away from the rest of the ground coat and cover coat, the crack splitting the ground coat more or less in the middle, as shown in Figure 4.

It should be pointed out that in Fig. 4 we have omitted the ground coat for purposes of simplicity, and, incidentally, have greatly exaggerated the thickness of the enamel. As the crack progresses through the ground coat, it frees a disc of material from its bed. Two things are happening there: First, this disc is enlarging as the crack extends out, and as it becomes larger it becomes easier to bend. As the deflection of the metal increases and the separated disc of enamel grows larger, there is a tendency to push this disc inward at the edges all around. When the freed area gets big enough and the force at the edges great enough, this disc buckles. When it does so, the surface is cracked in a number of pieces by the tension set up and the pieces fly off from the ware, leaving the spot of covercoat enamel attached to the metal in the center of the impact failure. Ordinarily, at least in the laboratory where tests were made with a sphere, there is a small piece of the original surface left apparently unharmed in the center of this spot.

The size of the area A-A, as shown in Fig. 4 within which the piece buckles, depends almost entirely upon the shape of the ware and the thickness of metal and enamel rather than upon the force of the blow.

For example, on one pan we hit a number of spots, one blow each, with different energies, and the area of the disc of enamel removed at the spot hit with a blow of 0.8 ft. lbs. was the same as that of spot hit with a blow of 0.2 ft. lb. A factor of 4 in the energy thus had little effect on the area of the enamel chipped off. Another example was found in pans for which there was 40-50 per cent variation in the energy required to chip off the enamel as various spots, while again the area removed remained practically constant.

This description of impact just presented is not complete. It is, rather, too simplified and neglects certain effects which occur sometimes around

Straight-Line Polishing

Several of the straight-line polishing units such as the one shown herewith which were recently placed in operation at the Ternstedt Trenton division plant of General Motors are 64 feet in length.

the point of impact, but it does show how these various physical features of the impact failure can be explained in certain cases, and it also shows how thickness and adherence may enter into the picture.

By way of summary, then, we have shown how and why we are attacking this problem; we have mentioned the principles which are of use here; and illustrated their application in two examples. But, I suppose at least some of you are asking yourselves the questions: "What if we know how these chips occur? What can we do with this information?"

The only answer that can be given is that it is the belief of those closest to this work that when we know what happens, when we know what we want to measure, we will know much better what kind of tests we need and, further, the information will help us a great deal in the interpretation of the results.

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Barrel Finishing of Metal Products

Factors in the Finishing of Zinc and Aluminum Die Castings by the Barrel Method

By H. LEROY BEAVER

WE HAVE been asked many times to prepare a paper with comment on the above subject, but to do so and give as complete information as a paper should supply, it would be necessary for us to depart from purely barrel operations and enter into the realm of electrodeposition of various metals in connection with die castings, a field in which we are not sufficiently familiar to speak with authority. In addition to this we have two separate and distinct schools of thought as to just what should be done with die castings insofar as barrel finishing operations apply.

Why the opinion should prevail among so many barrel operators that die castings do not lend themselves to barrel finishing practice we do not know, because the underlying principles of barrel finishing apply equally as well to die castings as to sand castings or indeed to stampings insofar as their operations in barrels is concerned. True, there are many and varied combinations of alloys used by various die casting manufacturers, each seemingly having their own pet theory as to what constitutes the most satisfactory "mix" for a casting for a given application. With these various theories we have of course no dispute, because after all, the barrel application will function about the same irrespective of the alloy with this important distinction, that, we do not recommend that die castings containing magnesium be barrel operated at all. They present too many difficulties in the barrel process. While die casting has reached a rather high degree of excellence, at the same time we would suggest that the castings as they come from the die caster should be carefully inspected for defects, because there are many things that a barrel operation will not cure, and only sound castings free from imperfections should be operated in a barrel process.

Perhaps the most simple question and the most frequent that comes to us is "Can die castings be barrel finished?" The answer, equally simple of course, is "Yes." The word "finished," however, is applied to several different operations because what would be considered a "finish" by one operator of a part to suit his particular requirement, would only be equivalent to a preliminary operation by another, and so we must consider the word finish to mean, first, a cutting down operation prior to plating, a simple barrel burnishing operation to give smoothness to the surface of a part whereby we somewhat alter the surface of a plastic metal by increasing its surface hardness, the barrel burnishing after the preliminary copper plating and then finally the final

burnish for lustre after the final plating operation, all of which, of course, are being successfully accomplished every day.

In speaking of zinc die castings, we know, of course, that in the process an oxide film forms on the surface of the castings. Well, one school of thought insists that this film must be completely removed in order to assure proper adherence of the subsequent electro deposited plate, while another school of thought insists that this same oxide coating be disturbed as little as possible, indeed that it be increased if possible by electro-chemical means to assure a proper basis on which to deposit the subsequent plate. In other words, one school insists the film or oxide must be removed and the surface etched to a rough matte finish by chemical means or else abraded to an equally rough matte finish by some mechanical means to assure adherence of the plate, the opposite school insisting that the surface of die castings be made as smooth as possible such as in the process of anodizing, but it is suggested that while the anodizing process increases the thickness of the oxide film, that this film is perforated by millions of tiny pore-like holes, and it is this that assures firmer and more uniform adherence of the plated surface. This anodizing treatment, however, we have found to vary considerably on aluminum castings and that to assure satisfactory results the thickness of the film should be not less than 8 to 10 microns or from .0003 in. to .0004 in. in thickness, and when this is achieved the life of the surface is apparently practically unlimited, even though no subsequent plate be applied.

In speaking of zinc base die castings, they, of course, can be barrel

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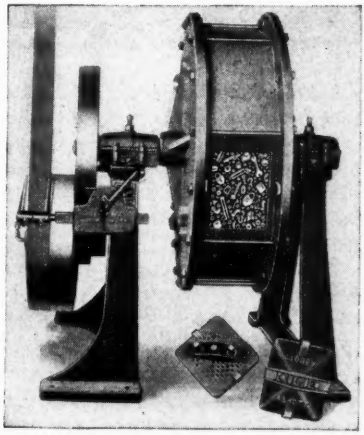

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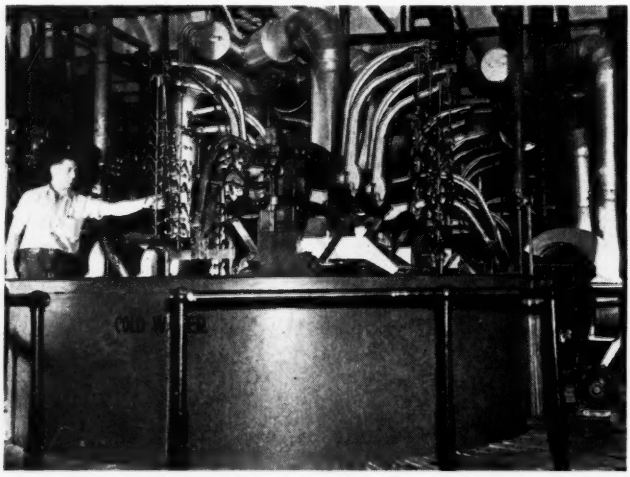
burnished, but unless such castings are intended to be subsequently plated we can see no point in a barrel operation insofar as it relates to a bright lustrous surface finish because the normal moisture in the air, coupled with gases and other oxidizing agents, will very quickly tarnish the highly burnished zinc surface, taking it back to its original appearance, and so far as burnishing to remove fins, and so on, it must be remembered that the softer non-ferrous alloys do not respond to the same form of barrel finishing treatment for the removal of burrs and fins as we would have on the ferrous types of materials. In the case of the non-ferrous alloys such an operation would only have a tendency to fold down the projecting fins on the surface of the part, thus causing "laps" or "pipes." Then, too, in a burnishing operation on zinc it would be necessary to use a water base lubricant in the barrel and a subsequent rinsing operation with water to remove the lubricating burnishing solution, and in this regard we recall a visit we made about a year ago to the plant of a nationally known die casting company for a discussion of the subject of barrel finishing zinc die castings, and the final conclusion of the discussion was that, the further away from water we kept the zinc castings the better off we would be.

Now in discussing zinc base die castings for that school of thought that insists on a roughened surface on which to deposit the plate, the following recommendation is made:

The first operation is to remove any unwanted projections left from the casting process such as remainder of gates and more particularly the projecting fin that marks the point of jointure of the dies. This is ordinarily done with wheels of from 180 to 240 grain, but if the projections are not large we would express a preference for the 240 grain alone, using only enough pressure against the wheel to remove the projection to the even plane of the surface of the casting and because cutting below the normal contour of the casting presents a considerable difficulty in



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smoothing over by the barrel process. After this operation of removing fins, and so on, which, as we have previously explained, cannot be successfully accomplished in an inanimate operation such as we would have in a barrel, the parts may be operated either in a horizontal barrel or an oblique tilting type of barrel, both of which should be of the wood shell variety. This being a dry grinding or roughing operation, the proportions of materials used will be different from that used in a barrel burnishing operation where steel burnishing materials are used. For this operation, the base material may be either maplewood sawdust or rather coarse texture or kiln dried corn cobs which have been hammer milled into a rough meal and in the proportion of four parts of the fibrous material to one part of the die castings by volume. To this load is added ordinarily F F pumice in the proportion of one quart by volume to each four quarts of fibrous material. F F pumice used in this way will produce a fine matte finish due to the fact that the pumice is comparatively soft and in the operation of the barrel it breaks down into successively finer particles. The operating time for this cutting down or roughing cycle will generally be about five hours, depending on the toughness and density of the oxide film to be removed, because this seems to vary somewhat in thickness and hardness, depending on the metals that may be alloyed with the zinc base of the die casting. If faster action is desired, we would suggest the substitution of a diatomaceous earth product which is rather high in silica and known as Celite. When used in a grain size equivalent to F F pumice the cutting action is faster, the hardness of the Celite by Mohs scale being about 6 as compared to the normal hardness of 3 of pumice.

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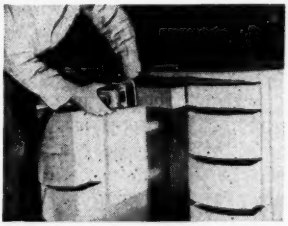

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It must be understood that die castings of either zinc or aluminum are comparatively soft as compared with other metals which accounts for the recommendation of the larger proportions of fibrous materials used in conjunction with the abrasive materials. Die castings are quite easily dented or marred when barrel operated and for that reason the speed of the barrel should be retarded, the maximum speed as a purely precautionary measure should not exceed 30 r.p.m., and in the case of larger, more intricately shaped pieces even this speed may prove to be a bit excessive. There may be no "throw over" of the parts in the barrel, for this invariably involves marring or denting or as it is sometimes described a condition known as "pecking." Where the action can be observed as in operating in an oblique tilting type of barrel, the flow of the mass of fibrous material and abrasive with the parts, should be smooth and even.

After the operation above described it will be necessary to clean the parts and in the case of zinc castings the cleaner should be comparatively mild, a rather widely used combination being as follows:

Na_2 CO_3 .....4 oz. per gallon
Na_3 PO_4 .....4 oz. per gallon
Na OH .....2 oz. per gallon

The parts may be operated in baskets for this cleaning cycle after which they should be thoroughly rinsed in clean, cold water from which they go direct to the cyanide copper plating barrel or tank.

After the cyanide copper plating operation the parts are carefully rinsed and they may then be barrel burnished in the conventional manner but it is always advisable in the case of soft metal die castings to use a larger proportion of steel burnishing materials than the customary 2 to 1 formula, this for the purpose of prevention of marring of the parts.

Following the barrel burnishing of the copper coating, the parts may again be passed through the mild alkaline cleaner as before described, after which they can be nickel plated. If bright nickel is not used the parts may again be given a light barrel burnish to bring up the lustre on the finished parts.

It is not be assumed from the above any implication upon our part that nickel may not be deposited directly on the zinc base die casting, for this too is being successfully done. It is our understanding that ordinary or average nickel solutions are not satisfactory due to the fact that they too quickly become contaminated by zinc that is disintegrated from the die castings and that a special nickel solution is required, the latter being much slower in action than the customary nickel formula analyses. While we do have formulas for such nickel solutions we do not give them in this connection for the reason that electrodeposition problems do not come strictly within the scope of our research work, which the readers of this series will appreciate is devoted almost solely to the preparation of parts for the electrodeposition cycle, and the further burnishing processes after plating.

Coming now to aluminum alloy die

castings for the school of thought that tends toward the roughing of the surface of the castings to secure better adherence of the plate, the same procedure may be followed and the same materials used as hereinbefore described for use in connection with producing matte surfaces on zinc die castings, but in the case of aluminum castings, they being pretty generally harder than the zinc base castings, the operating time will be somewhat extended.

So long as the cutting action achieved by the use of fibrous materials and abrasive are much the same, we would ask that the reader remember that when we come to purely barrel burnishing operations we needs must consider the variation in the specific gravity of the aluminum parts as contrasted with the specific gravity of the steel burnishing materials ordinarily used, this variation being so marked that by the action of the resultant force within the steel burnishing mass, the aluminum parts due to their lower inertia are forced completely out of the burnishing mass and will float on top of the mass receiving little or no pressure from the mass. This can be overcome in only one way and that is to load the barrel almost full of burnishing materials and parts in which case the barrel and its load must be carefully considered to avoid deformation of the parts due to too heavy a load of burnishing materials. In such type of loading the speed of the barrel may be somewhat increased because the action is much retarded as compared to the function of the same barrel when loaded to the conventional ⅔ full.

Here we must point out that scrupulous cleanliness is essential. A wood lined burnishing barrel that has been used on other types of parts and where the stronger alkalies and perhaps cyanide has been used, will be generally found to have these alkalies impregnated in the fibres of the wood lining, and also as linings are seldom if ever completely water tight, much of such solutions will lie between the wood lining and the outer metal shell of the barrel where they are exceedingly difficult to remove. When barrels of this kind are sought to be used for the barrel burnishing of aluminum parts discoloration is generally the result, so that if the burnishing of aluminum parts is a regular production procedure it is always best to maintain a barrel exclusively for this work. True, in some cases, successive washings of a barrel may render it satisfactory for burnishing aluminum, but generally the loss of production time in such cases is too great.

As we have so often stated, a proper soap for burnishing any of the popular metals susceptible to finishing by this method, provided they are

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first properly cleaned before placing in the burnishing barrel, need not necessarily have much in the way of detergent properties, because lubrication and not cleaning is the major and definite function of the soap solution. For this reason, a very mild vegetable base soda soap of rather lower titer than the customary 40 to 42 of hard tallow base soaps may be used. Such soaps may be had which show little or no free alkali and are almost neutral, and soaps of this kind function very satisfactorily in the barrel burnishing of aluminum parts.

Grease spots, finger marks, and so on, on aluminum parts must be removed prior to barrel burnishing either by an alkaline cleaner or acid dip. An alkaline cleaner that is mild and comparatively simple in operation is made up as follows:

Sodium Carbonate (Na_2CO_3)
1 to 3 oz./gal.
Trisodium Phosphate (Na_3PO_4)
1 to 3 oz./gal.

This cleaner is used hot at 180 deg. to 200 deg. F. It will mildly attack the surface of aluminum parts and the "gassing" removes grease in the same manner as an electric cleaning.

Following the alkaline cleaner an additional acid cleaning operation may be used by dipping the parts for from ten to fifteen seconds in a 5 per cent hydroflouric acid solution made up of one part of 50 per cent hydroflouric acid to nine parts of water. This will remove any alkaline cleaner left on the surface of the parts. If the amount of grease on the surface is slight such as finger marks, the alkaline cleaner may be dispensed with because the hydroflouric acid will remove the grease. This will give a uniformly clean surface of a rather high white color, and the operation should be always followed with a cold water rinse.

We are also asked in connection with the barrel finishing of aluminum die castings what should be done with castings that have been anodized. Should they be barrel burnished prior to plating? Our understanding of this process is that the operation of anodizing is an electro-chemical method for increasing the thickness of the normal oxide film, but that this oxide anodized film coating is decidedly porous or as expressed by one commentator, the anodic coating is "skeletonized" or rendered at least partially porous and that in this condition it forms a closer bond with the electro-deposited metal on its surface. If this is true, and the explanation seems to us to be reasonable, then we would say that a barrel burnishing operation prior to plating would only have a tendency to close the porous areas in which case, if the porosity was a factor in the adhesion of the plate, then the barrel burnishing operation would have no value and indeed would defeat the result sought to be secured by the anodizing process.

We have commented in previous papers relative to the plasticity of various metals, and do not deem it necessary to repeat this comment in connection with zinc and aluminum, for the previous comment may now be considered in connection with the present discussion relative to these two metals.

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Diffusion of Zinc and Iron at Temperatures Above the Melting Point of Zinc

By WALLACE G. IMHOFF
President, The Wallace G. Imhoff Company, Vineland, N. J.

THIS research investigation is a continuation of that very fine piece of research work done by Gilbert Rigg, and described in the "Journal of the Institute of Metals," Vol. LIV, No. 1, 1934. The research work of Mr. Rigg has the same title, except one word, "below" the melting point of zinc. The writer was extremely interested in studying the results found by Mr. Rigg because an extensive research investigation of the diffusion of zinc and iron at temperatures above the melting point of zinc seemed to indicate that some very powerful hidden relation exists between these two metals. Since further investigations revealed that the metal zinc will attack and destroy most other metals and alloys, it was thought that the hidden power of destruction was to be found in the zinc, rather than in the other metals or alloys.

The writer has inclined to think that perhaps these peculiar properties of zinc may be due to traces of gallium, indium, and thallium, also found in rocks and minerals containing zinc. Gallium is found in nearly all zinc blende, indium frequently, and thallium occasionally; indium is found in all tin ores; but none of the three are found in lead ore, galena. Gallium (alloyed with some indium) has been obtained from Missouri zinc. The quantity of indium in Missouri zinc appears to be less than one-tenth of that of gallium. A little germanium occurs with the gallium in the zinc oxide. Are these rare elements then the cause of the extraordinary behavior of the metal zinc?

Rigg's researches have shown that diffusion of the zinc and iron commences at 300 degrees C. (572 degrees F.), and is fairly rapid above 380 degrees C. (716 degrees F.) It is of particular interest to call attention to his statement as to how it p r o c e e d s, which is as follows—"it proceeds by the formation of cones of diffusion products which spread out from isolated points where the contact between the metals is most perfect, and gradually penetrate into the zinc and across its surface."

Scope of This Research

As mentioned above, Rigg's investigations were below the melting point of zinc. The scope of the writer's investigations are above the melting point of zinc, and up to a temperature of 1,565 degrees F. The method of conducting the test was to place a 28-gage steel sheet in a bath of commercial quality zinc used for galvanizing, heat to the desired temperature, hold for six hours at that temperature, and then cut off the gas in the small furnace in which the cruci-

ble rests, and allow the melt with the steel sheet in it, to cool slowly over night in the furnace.

When cold, the melts at different temperatures were readily removed from the crucible, sawed in half, and one-half used for chemical analyses, while the other half was polished, and etched, and studied under the microscope. Tests were started at 800 degrees F. and carried out every 50 degrees F. up to 1,000 degrees F., and from there at 1,100 degrees F., 1,300 degrees F. and 1,565 degrees F.

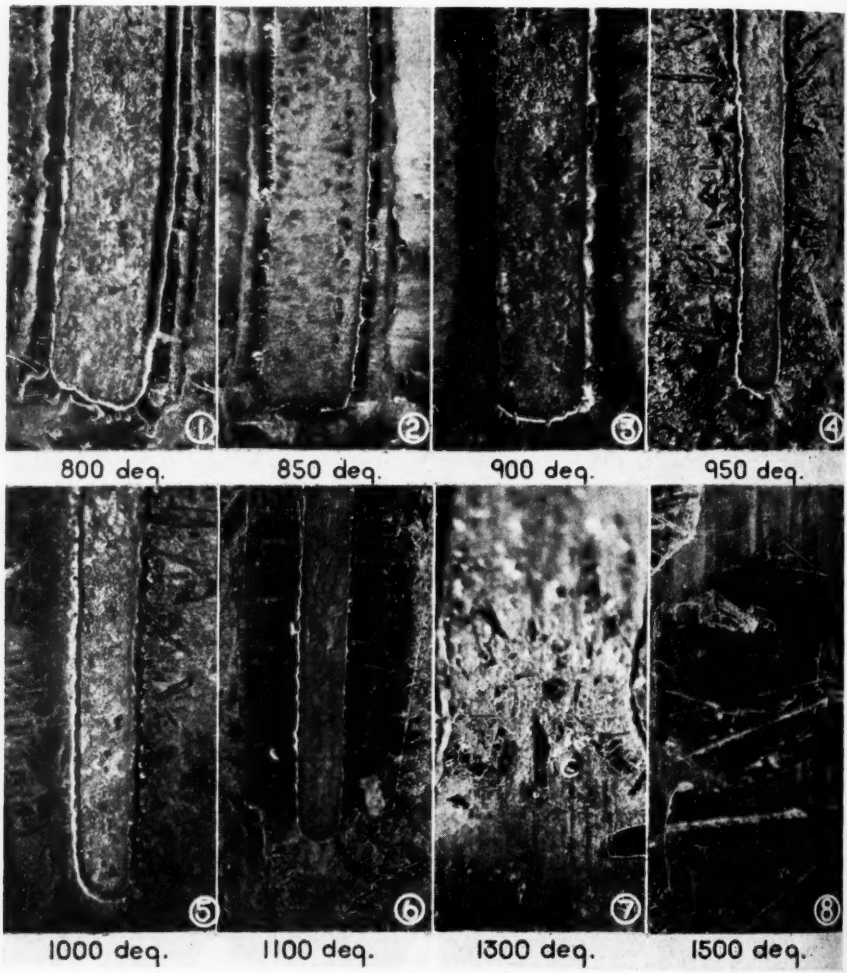

Fig. 1—Illustration showing the result of 28 gage steel sheet in a zinc melt at temperatures ranging from 800 degrees F. to 1,500 degrees F. The magnification of the specimens is 40 diameters.

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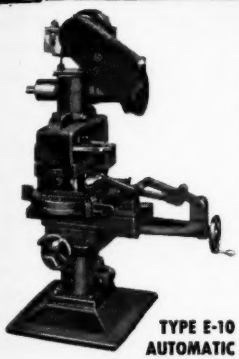

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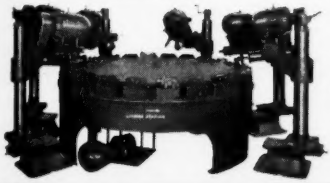

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Fig. 2—A cross section of the melt with the iron sheet in it at a temperature of 950 degrees F.

Results of Research

The results of the tests are shown in Figure 1. The piece of sheet steel down in the zinc melt at the different temperatures is shown under a magnification of 40 diameters. Only a slight diffusion of the iron into the zinc was seen to have taken place at both 800 and 850 degrees F. As mentioned by Rigg, two very distinct alloy layers can be seen (the very fine white line is a crack between these alloy layers and the base metal). The alloy next to the iron sheet is very much higher in iron, and is therefore darker.

Feeling the pulse of the experiment it was found the alloying action is not perceptible until a temperature of 860 degrees F. is reached, at which temperature distinct action becomes apparent. At a temperature above 860 degrees F. the diffusion becomes gradually more rapid with a rise of temperature. At about 900 degrees F. a very clear, sharp increase in intensity of the diffusion becomes apparent. This acceleration in diffusion of the iron is very plainly shown in No. 3 at 90 degrees F. Attention is called to the very wide black band of zinc-iron alloy that has diffused out into the zinc on both sides of the sheet.

The most critical phases of diffusion of the iron into the zinc may be seen by observing the melts above 900 degrees F. For practical purposes of comparison the magnification of all the melts was exactly the same, and therefore by comparing Nos. 1 and 4, some idea of the rapidity of the diffusion at 950 degrees F. may be obtained. Under identical conditions of test except for the higher temperature, in the same time by actual measurement it can be seen that only half of the sheet remains. A little rough practical information may be derived from this fact. A 28-gage steel sheet after being pickled is approximately 0.015 in. thick. From the above test at 950 degrees F. the sheet was about half dissolved in 6 hours time, or it may roughly be assumed the entire sheet will dissolve at this temperature in 15 hours, which is at the rate of 0.001 inch of steel per hour at 950 degrees F. A steel plate 1 inch thick at 950

degrees F. would at that same rate last approximately 42 days. This information is, of course, only approximate, but it is of interest in connection with the life of galvanizing pots, which at times reach that high a temperature at the bottom of the pot.

Since the diffusion of the iron into the zinc is the most interesting at the temperature of 950 degrees F., some other views of the melt are submitted for observation. Figure 2 shows a cross section view of this melt at 950 degrees F. Attention is called to three or four very interesting things. First, it is a remarkable fact to see that the zone of diffusion of the iron into the zinc has been confined to a very small distance out into the zinc on each side of the sheet. The whole top of the melt will be seen to be clear zinc crystals uncontaminated with iron. The second feature of interest is that the zinc-iron alloy formed by the diffusion due to its greater specific gravity than the zinc, has simply flowed down the sheet, or dropped to the bottom of the melt, and formed a very large cone-shaped pile of zinc-iron alloy crystals at the bottom of the melt. This pile of crystals half way up the sheet can be plainly seen. The third feature of interest is to note that larger, darker, zinc-iron alloy crystals have separated out at the very base of the melt, down in the zinc-iron alloy pile. The fourth feature of interest is to note that the steel sheet down in the melt, is just about half of the thickness of the bent over part of the sheet sticking out of the top of the melt in the center. A very important fact is brought out in this plate, namely, that the zinc-iron alloy does not tend to diffuse far out into the zinc, but rather, as soon as formed, it tends due to it greater specific gravity to drop at once to the bottom of the melt. This fact is clearly shown by the way the zinc-iron alloy has piled up at the bottom of the sheet, while at the top of the sheet it tends to stay very close to the sheet, and not to diffuse out horizontally into the bath. No. 4 is an enlarged view taken right at the bottom of the sheet. Attention is also called to the haze of dark zinc-iron alloy crystals

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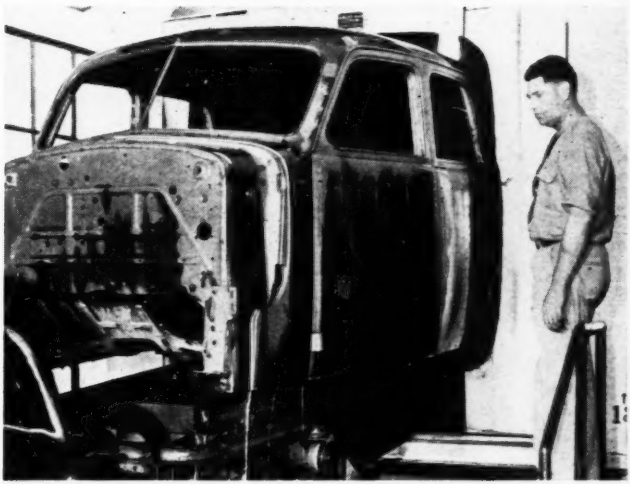

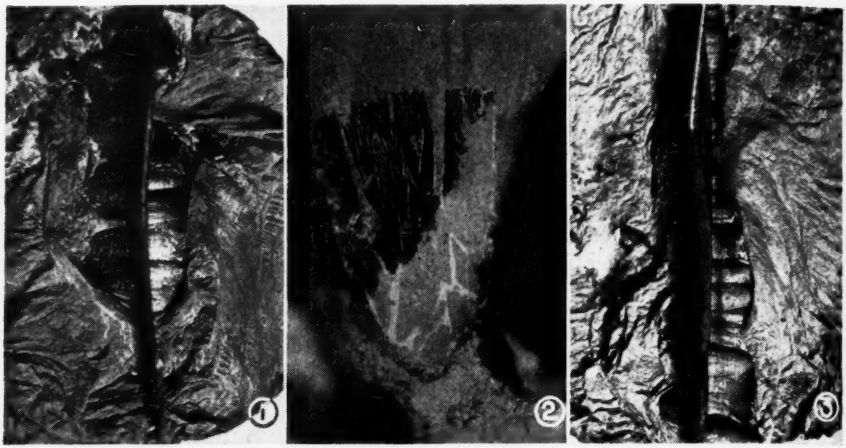

Fig. 3—Alloy cones developed in melt at 950 degrees F. (1) Top view of alloy cones on melt. (2) A cross section view of a very large cone. Magnification 40 diameters. (3) Another view of the alloy cones formed on both sides of the sheet.

on both sides of the sheet in the pile, or cone of material that has settled out at the bottom of the melt.

Alloy Cones

It so happened that the only test which the writer made that developed Alloy Cones was the melt at 950 degrees F. All other melts made did not have any of these cones, nor was there any evidence that any cones had tried to form. In view of the fact that Rigg had alloy cones develop at about 700 degrees F., the only explanation that can be offered here is that perhaps these cones formed at that temperature when the melt was cooling.

Rigg both by computation and otherwise found that the chemical analyses of three of his cones were as shown below:

Per Cent	Cone A	Cone B	Cone C
Fe	10.6	13.1	13.5
Zn	89.4	86.9	86.5

When six of the cones shown in Figure 3 were broken off the sheet and analyzed, the writer found they averaged only 4.24 per cent iron.

If we observe closely the enlarged alloy cone in Figure 3, the middle picture 2, it will be seen that there are three distinct alloys shown, and perhaps four. These are as follows:— 1. The very light streaks at the very point of the cone; 2. The main body of the cone; 3. the alloy in between the dark areas; and 4. the dark areas at the left.

Diffusion Above 950 Degrees F.

As previously mentioned no alloy cones were formed either above or below 950 degrees F. in any of the melts. For some unexplainable reason, perhaps experimental error, but the same thing happened in a number of tests, the diffusion was most violent at 950 degrees F. and then at both 1,000 and 1,100 degrees F. the violence or rate of diffusion was less than at 950 degrees F. At the 1,300 degrees F. (Figure 1, No. 7), the steel sheet dissolved up entirely in the zinc. Only the top outline of the sheet is left.

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The same thing happened at 1,500 degrees F. Thus from a practical standpoint the dissolving action at 1,300 degrees F. is about two and a half times as fast as at 950 degrees F., or .0025 inches per hour.

Mechanism of Diffusion

The work done by Rigg below the melting point of zinc was conducted in what might be termed the opposite of the research investigations of the writer. For example, to bring out clearly what is meant, Rigg's tests were conducted with a zinc sheet between two steel plates, while the writer's researches were conducted with a large body of zinc, and a small light 28-gage steel sheet placed in the melt, a condition which might be thought of as opposite from Rigg's conditions. In the first case there is iron on both sides of the zinc, and in the second case, there is zinc on both sides of the iron. This may account for difference in temperature at which Rigg's alloy cones were formed, and the temperature at which the writer's were formed, which was very much higher. It may also account for the difference in iron content of Rigg's cones which was 10.6 to 13.5 per cent as compared to the writer's cones which averaged only 4.24 per cent iron.

Rigg explains his structures as follows:—"Diffusion begins at a number of points of contact between zinc and steel which are more perfect than in the areas between. As the iron diffuses into the zinc a depression is formed in the steel surface, the diffusion product remaining adherent to it and drawing down with it the zinc to which it also adheres, so that as the process continues the surface of the zinc surrounding the original projecting point comes into contact with the steel, and the iron begins to diffuse into it. The depression, consequently, increases in area, but is always deeper at the center, as the process of diffusion has been going on longer at the center than at the periphery."

In order to clearly understand the diffusion or mechanism of disintegration above the melting point zinc it is necessary to look at Figure 2 and to follow closely from the illustration the path of the iron from the steel plate, or sheet, into the zinc melt, and then out again in the form of a zinc-iron alloy crystal. The diffusion is kept going by the taking of the iron out of solution into the alloy crystal, otherwise the diffusion process must stop because of saturation of the zinc by the iron under the given conditions.

The diffusion mechanism is a complete cycle, starting first with the iron particle, out of solution as a part of the steel sheet. The forces in action first tend to move the iron particles over into the zinc. A study of the alloys formed in Figure 1 shows iron fragments in every case moving out into the zinc bath. What actually happens seems to compare mechanically with the breaking up of an ice pond in spring time. First there is the solution of the iron into the zinc. This weakens the main body of the iron and gives a layer composed mostly of iron, or a very iron-rich zinc alloy. The next stage of the process combines both solution of the iron in the zinc, and disintegration of large areas of the iron-rich zinc alloy into fragments or flating cakes in the main zinc bath. These large iron-rich cakes or fragments dissolve up completely into the bath forming zinc-iron alloy. This is a zinc-rich solution, and like a saturated galvanizing bath has a higher specific gravity, due to the iron in solution, than the pure zinc. For example, the specific gravity of zinc is given as 7.14 and the specific gravity of saturated galvanizing bath

(not dross), is about 7.2 to 7.3 depending upon the temperature. Thus the first stage of the process is complete when the solid iron fragment of the steel sheet has passed through the various stages of disintegration and solution, until it is in solution in the zinc. More and more iron particles keep coming into this zinc bath by this first step of the process, until finally under the given conditions the zinc at that place becomes fully saturated with iron particles, and it cannot hold any more. The diffusion process therefore would stop itself at this point of complete saturation if a way was not provided to remove some of these iron particles in solution.

This is where the next step of the diffusion process starts. Zinc and iron form definite alloys at different temperatures. These zinc-iron alloys crystallize in the hexagonal system. At this point the forces of crystallization go to work. First just the boundary, or outline of the crystal takes form by the iron particles being removed from the bath as this zinc-iron alloy. The forces of crystallization tend to make full crystals of the alloy, or the crystals tend to grow and fill out solid with zinc-iron alloy. As this process goes on removing iron, and reducing the saturation of iron in the zinc, the diffusion process and disintegration process goes on destroying the sheet. In the first part of the process the iron is going into solution from the sheet, and in the second part of the process, the iron is being taken out of solution, and reducing the saturation, and making it possible for the diffusion to continue, by the iron being removed by the forces of crystallization of the zinc-iron alloy crystals which take the iron out of solution, and build it up into a zinc-iron alloy crystal. Thus by referring again to Figure 2 it will be seen that the iron in the sheet first diffuses lose into the thin white area seen on each side of the sheet. These fragments being heavier than the zinc slip down, or drop down the sheet into the pile of zinc-iron alloy below. Finally this zinc-iron alloy becomes saturated, and the iron is removed by the formation of the zinc-iron alloy crystals (heavy black crystals seen at bottom of the melt) which separate out, and take, or remove the iron from the bath, and take it out again into the solid form. This is the complete mechanism of the diffusion process. The iron particles are removed from the bath when it becomes saturated with iron, by the forces of crystallization which tend to form the long, slender, rhombohedral zinc-iron crystals which belong to the hexagonal system of crystallization.

The mechanism of diffusion, or how the diffusion goes on has just been

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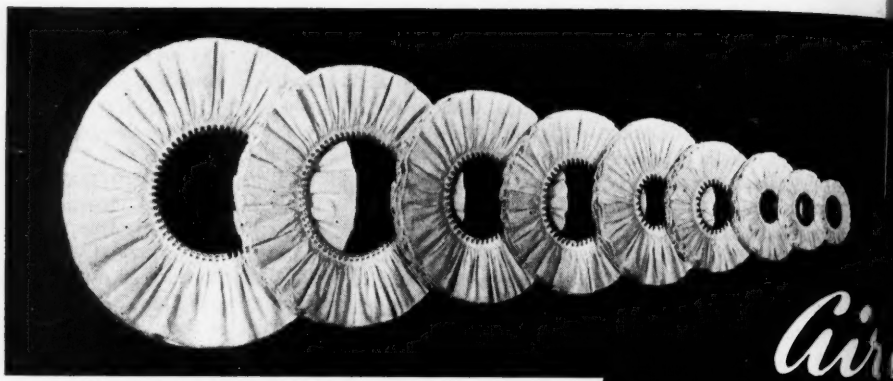

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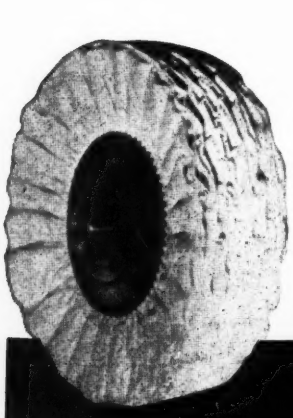

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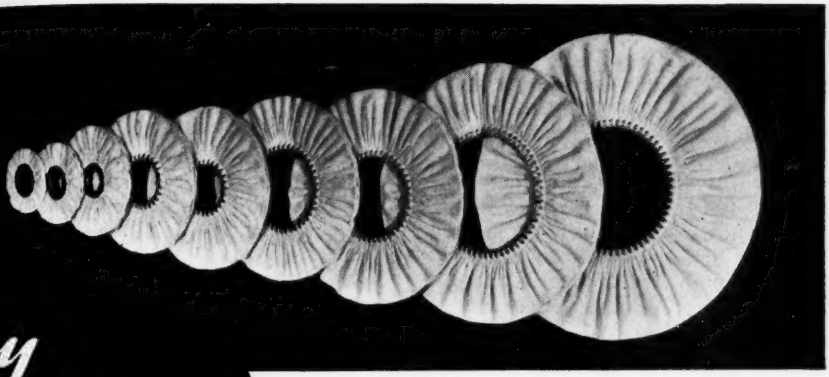

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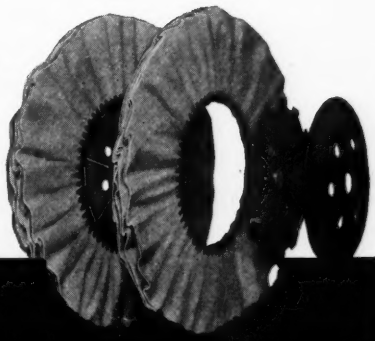
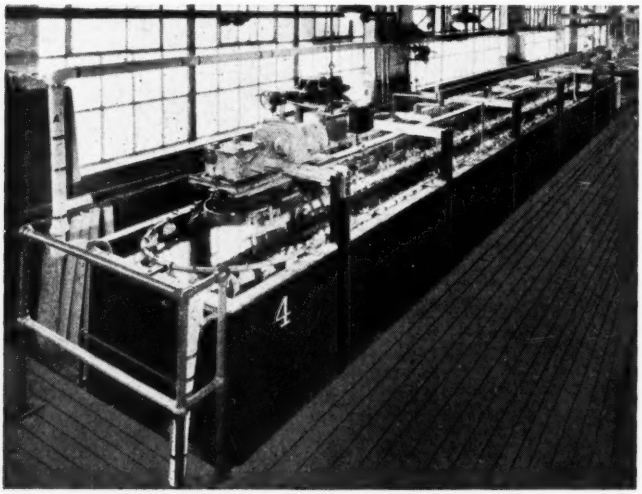


described. There is, however, another part of the diffusion which must be described, and that is the medium through which this diffusion, or mechanism works. To understand the actual diffusion it is necessary to name the component parts of the medium through which the diffusion works. These component parts in the process are first the two metal components the zinc and the iron. In Rigg's researches both metals were in the solid state; in the writer's researches the iron was in the solid state, but the zinc was in the molten state. The common meeting place of the two metals is a zinc-iron alloy solution. There are three variables, namely, zinc, iron, and temperature. As the temperature goes down the zinc increases (iron decreases); as the temperature goes up, the iron increases (zinc decreases).

There seems to be at least two critical points, or we might term them "getting off points." Up to a temperature of 900 degrees F. the solution when saturated produces a zinc-iron alloy crystal of the long slender needle type (rhombohedrons in the hexagonal system); above 900 degrees F. the zinc-iron alloy crystal form changes to a Pyramid of the First Order in the Hexagonal System. In the change with increase of temperature, zinc is lost; that is, the iron content of the zinc-iron alloy crystal increases.

The whole basic foundation of the diffusion of the iron into the zinc depends upon the removal of the iron again from the saturated melt by the forces of crystallization that, according to the temperature, gives the long slender rhombohedral zinc-iron alloy crystal under 900 degrees F., or the six-sided hexagonal pyramid zinc-iron alloy crystal above 900 degrees F. At any given point in the system the state of the products will depend upon the temperature, and the amounts of zinc and iron present. The melt may consist of pure zinc on one end, and pass through all stages of zinc-iron alloy in liquid solution increasing in iron content, and passing on over to the pure iron component on the other



Rubber-Lined Nickel Plating Tank

Vacuum cleaner parts are nickel plated in this Triflex rubber-lined nickel plating tank which is 40 ft. long 50 in. wide, and 36 in. deep.

(Photo Courtesy The B. F. Goodrich Company)

end. This liquid solution is the medium through which the mechanism of diffusion operates, and the products that appear at any particular time depend upon the amounts of the zinc and iron present, the saturation of the melt in iron, and the temperature.

The results of these investigations with those of Rigg clear up the mechanism of the destruction of the galvanizing pot, and also account for the continued absorption of iron from corrosion, etc., on the work going into the pot, and the constant removal of the iron when the bath becomes saturated with iron, by the formation of the zinc-iron alloy crystal (long slender needle-like crystals, rhombohedrons) under 900 degrees F., and the small hexagonal zinc-iron alloy pyramid crystals above 900 degrees F. Diffusion of the iron into the zinc is only half of the process; the other half of the mechanism is the removal of the iron from the saturated melt by the forces of crystallization which build up the zinc-iron alloy crystals. The kind of crystals built up depend upon the temperature.

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Pertinent Spray-Gun Pointers

By Frank V. Faulhaber

With spray guns finding increasing use even on the highest grades of work, it will not be amiss to give consideration to some important technical points. Today there is extensive range and variety of spray guns; it is essential, however, that the finishing department obtain the right gun for the right purpose, then those responsible should see to it that proper care and use apply.

A spray gun may be the most expensive of its kind, serve admirably under certain conditions on certain kinds of work, yet prove unsuitable for one's particular purposes. Moreover, one operator will obtain satisfactory results with a certain spray gun, while another worker, on the same work, will complain that the gun is ineffective—and he may be correct. Some spray operators, peculiarly, can achieve wonderful effects with almost any kind of gun, under almost any kind of conditions. They are past-masters, experts.

To prove effective, a spray gun, under right use, should give uniform results; no splitting, no dry spots, no dark center, and as little mist or overspray as possible. A requisite should be that the spray gun parts are readily interchangeable, so the spray guns can be procured on short notice, and be stocked inexpensively. The nozzles should be easily and accurately adjustable. The spray gun should not be of that sort that clogs too easily, should be durable — and stand hardy service; and yet be simple as possible, mechanically. The spray gun should clean easily, without fret or fuss, and be constructed with a minimum of parts contacting with the liquid, and these parts should be accessible. The spray operator should have a gun assuring a comfortable grip and proper balance, so as not to tire quickly the hand.

A majority of the spray guns are manufactured for low or moderate air pressure. Experienced finishers claim a greater covering capacity for the low or moderate air pressure guns, and with their use there is possible firmer adhesion. It has been found, too, that such pressure guns permit better flow, that there is no removal of volatile content, fewer fumes, and less mist, overspray or drift. On the whole, such guns in the long run are considerably cheaper. Spray guns are assuredly not all alike in price; the knowing, far-sighted foreman or finisher, however, will choose his preferred gun, even though the initial outlay may be a little more. Under practically all working conditions the spray operator should have a gun giving complete control of air and liquid, so that both can be regulated with ease.

The best spray gun may seem a puzzle or trial in inexperienced hands. It is advisable for the operator to understand his spray gun thoroughly, and to possess knowledge as to its proper use, if satisfactory results are to be obtained. Manufacturers' instructions should be heeded. It must

be borne in mind that spray guns are very finely constructed, and that proper care and use of same prevail at all times — not only some of the time. The spray gun operator should be dissuaded from any inclination to toy, experiment unnecessarily with the tool. Not more of the spray gun should be dismantled than necessary. Sometimes a curious sprayer will take his gun apart—"to see how it works" —and ever after he may never again be able to secure the results the spray gun manufacturer intended should be obtained.

New operators, particularly, may be uninitiated about this important point, therefore should be duly cautioned and enlightened. Some operators, perhaps unknowingly, will ram a piece of wire into the air outlets, and the gun may be of such a type, and of that kind of metal, that will not withstand such mishandling. It is possible to abuse and break down a spray gun, albeit unintentionally, and though the operator means well. Many spray guns have forever been put out of use completely just because of wrong cleaning methods.

In one particular case, an outstandingly admirable spray gun, delicately constructed, and of soft metal, was condemned as of no further use, just due to improper, clumsy cleaning, and the finishing department never realized where the trouble lay. A different sort of gun was decided upon. The new gun, however, unfortunately did not serve well, and the shop was kept under a nervous strain and a long run of experimenting, consulting, and buying, until finally it came home with full force that not the gun but the user was at fault. It can be seen, therefore, where carelessness, ignorance or toying may lead one to. It should be almost needless to state, incidentally, that the careful spray operator will never allow carefree boys or unauthorized others to use his gun.

There are divers spray gun troubles such as split or hollow spray, lop-sided or one-sided spray, fluttering or jerking spray, excessive mist, excessive flowage, fluid leakage, inefficient atomization—any of which may make for inferior results. There's a cause aback each one of them.

When the liquid distributes streakily we have what is known as split spray; there will be heavy coating on the outer edges of the fan spray, with very little material depositing in the center. This defection may be due either to wrong adjustment of the spreader adjustment valve, or due to excessive air pressure causing blowage of material from center of spray.

When the fluid gravitates inordinately heavy on one side of the fan-shaped spray, causing very uneven coating, we have lop-sided or one-sided spray. The cause may be traced

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to cloggage of the air port on the air cap. Sometimes a bent air port or a split or bent edge on the fluid tip may bring about the trouble. Should the air port clog, the operator must never resort to wire probing or cleaning. Instead, the air cap should be placed in a solvent appropriate for the material in use, thence blowing it out with air.

There may be any number of reasons why the spray gun air port has been turned to one side or bent—careless handling, dropping of gun onto the floor, and such. A new air cap is then called for, as ordinarily it is next to impossible or inadvisable to straighten the bent air port, or expect to restore the impaired air port to efficient use. Sometimes, through long overuse, the steady wear of the fluid needle on the fluid point may cause it to become thin and split. Usually new parts, then, represent the most advisable procedure. There have been cases where, because of ignorance or economy, the management required the spray gun operator to worry along with defective parts, resulting altogether in decidedly poor work—proving in the long run that ignorance is costly, as is likewise any questionable saving.

When the operator encounters difficulty with fluttering or jerky spray, it is impossible to coat or spray at all. The material issues from the tool in jerks, causing patchy spraying or coating of the product. There are a number of reasons. The fluid tip may be loose, or cloggage of the gun; the latter sometimes by a bit of dirt or foreign substance. The air may be leaking into the fluid line, or there may be a worn-out fluid-tip gasket.

An overplus of mist over the product represents another disconcerting spray problem. This may come about through increased flow of finish or excessive air pressure. When the material uncontrollingly drops onto the work, the annoyance is leakage at point of fluid tip. Under such circumstances excellent work is absolutely out of the question. A worn-out fluid needle or needle improperly regulated may be the cause. Especially where lacquer is sprayed, it is advisable to have a number of needles in readiness, for under such use the wear is more severe. Incidentally, it will not be out of place to be adequately supplied with replacement parts to permit quick repairage of gun, so as not to hinder or disrupt the plant output. From time to time, one or another part of the gun will become deficient or break, and this happens more times than the finishing foreman may wish.

Bad sprayage may be due to excessive flow. Every spray gun has its own peculiar instructions, and these must be recognized and understood to assure efficient adjustment of all parts and desirable performance, unvaryingly, of the gun. Otherwise, there may follow disgusting sags and runs, particularly on "classy" work. Needless to indicate, such sags and runs should be avoided on all types of work; these are objectionable even on the rougher work. So many spray troubles arise simply because too much material issues; there is lack of uniform control, resulting in overcoating, and uneven spraying. And it doesn't matter what kind of finish is being used.

Faulty atomization results in a pebbly effect, another finishing worry, all the more so when there is poor flowage. The finish may be too heavily-bodied or there may be too low pressure. Verily, the troubles of the spray gun operator are not too few.

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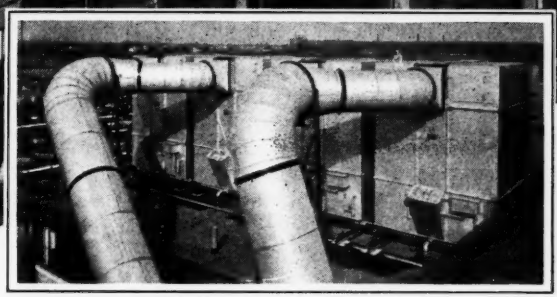

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MAHON

Metal Finishing Highlights of 1938

By FRED W. VOGEL
Managing Editor, PRODUCTS FINISHING

CONSIDERING the prevailing impression that we are living in a mechanized, efficient world, it is significant that the trend during the past few years has been generally in the direction of appearance. During the year 1938 this trend became more pronounced, the development of industrial aesthetics being reflected in a tendency toward beauty in the design of factory buildings, a more pleasing appearance in machinery design, the use of color and metal plating on locomotives, and so on.

The importance of the finishing department in the industrial plant has become more conspicuous and the attention of all industry has been increasingly directed toward the development and use of new methods, new materials, and new equipment for the application of finishes that aid in appearance and utility. The outstanding method, process, and equipment developments of the year 1938 in the metal cleaning, plating, polishing, and finishing field are summarized in the following article.

One of the interesting metal preparation processes that was developed is known as the "Anodex" Process which was placed on the market by MacDermid, Incorporated, Waterbury, Connecticut. This process is a method of cleaning steel and copper plated work while racked prior to any subsequent finishing operation. The Anodex compound used in connection with the process is a white powder which

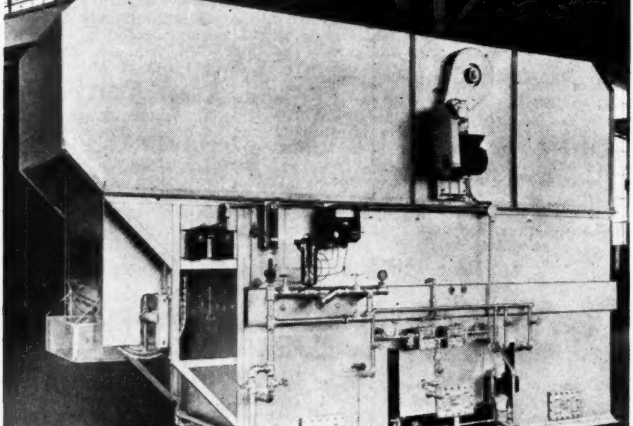

Fig. 1 — Automatic Three-Dip Type Detrex Degreaser equipped with cross rod conveyor and arranged for loading and unloading work at one end.

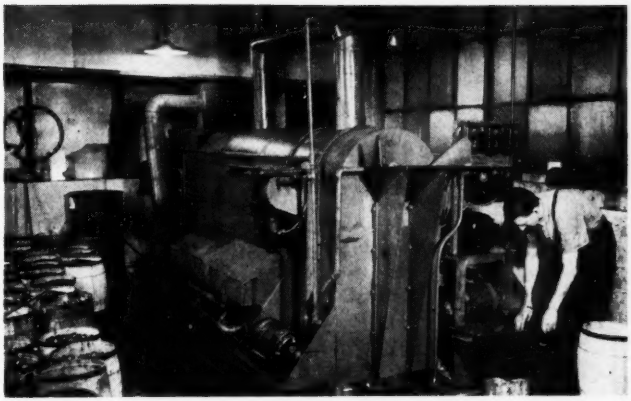

Fig. 2 — Illustration showing a Ransohoff continuous wash, rust-proof and drying unit.

is said to contain no moisture and is 100 per cent soluble in hot water.

For most work, it is not necessary to purchase new equipment to install the Anodex Process, since it is used in steel tanks in the same manner as in ordinary alkaline cleaning. For maximum efficiency, a temperature of 200 deg. F. and a current of 50 amperes per square foot and a concentration of 12 ounces of Anodex compound per gallon of water is recommended.

The Anodex Process is used only with reverse current and the work to be finished can be taken directly from the stamping or buffing room, racked and put into the solution charged with Anodex compound. The time, which varies from 30 seconds to 3 minutes, depends upon the degree of contamination. Following the cleaning operation, the workpieces may be rinsed in cold water, dried, lacquered, japanned, or, in the case of an electrodeposit, acid dipped, rinsed, and plated.

A Conveyorized Three-Dip Degreaser, shown in Fig. 1, was placed on the market by Detroit Rex Products Company, Detroit, Michigan. This machine is used for the removing of oil, grease, and dirt from all kinds of work, such as stampings, castings, and screw machine products prior to painting, plating, and inspection.

The sequence of cleaning operations, which are performed automatically after a basket of work is hung on the cross rod of the conveyor chain, is immersion in boiling solvent, immersion in clean solvent rinse, and final cleaning and drying in pure solvent vapors. The metal parts or assembled products are cleaned with stabilized non-inflammable, non-explosive safety solvents — either Perm-A-Clor or Triad. Following the degreasing operations, the parts are ready for finishing without any scrubbing or extra dryoff.

The approximate overall dimensions of the Conveyorized Three-Dip Detrex Degreaser are 12 ft. long x 6½ ft. wide x 10 ft. high. This unit has a total solvent capacity of 250 gallons and the approximate weight of the complete unit is 6,300 pounds. At a normal conveyor speed of 6 ft. per minute, the rate of production cleaning capacity is 2,000 pounds of work per hour. The minimum production rate is one basket per minute and the maximum cleaning rate three baskets of work per minute.

This automatic machine is equipped with a return-type cross rod conveyor designed so that the machine can be loaded and unloaded at one end. Cross rods, from which baskets of work are hung, are spaced at reg-

ular intervals along the two-strand conveyor chain. Oilless bearings are used on all sprockets inside the vapor zone.

The degreaser is fabricated from steel plate, reinforced with structural steel and is of all-welded construction. The inside surface is hot zinc spray coated following fabrication.

The solvent boiling chamber is heated by a steam jacketed bottom and coils. The solvent transfer pump can be used to transfer solvent into or out of the machine and between any of the chambers. Each of the three chambers — boiling chamber, clean solvent rinse, and vapor chamber — are equipped with removable clean-out doors.

E. F. Houghton & Co., Philadelphia, Pa., brought out a new variety of Houghto-Clean in the form of a powdered cleaner to be used in hot solution in the mechanical or electrolytic cleaning of strip steel prior to tin plating. This cleaner is said to be balanced and retains absolute uniformity during the cleaning operation. One of the outstanding features of this cleaner is that it can be easily controlled.

A continuous wash, rustproof and drying machine for handling small stampings and screw machine work, illustrated in Fig. 2, was placed on the market by N. Ransohoff, Inc., Cincinnati, Ohio. In this machine, the work is soak washed, spray washed, sprayed with a rustproofing solution and dried. The machine is so designed that a rinse can be substituted for the rustproofing spray if so desired.

Threaded work can be handled without injury in this machine due to the use of a drum head construction. The machine is equipped with a belt conveyor onto which the work discharges and on which it is carried back to the charging end so that one man can handle the complete operation.

Another development of N. Ransohoff, Inc., is a combination belt and monorail machine for washing and drying stamped steel parts, which is shown in Fig. 3. The monorail conveyor is an integral part of the shop conveyor on which the parts travel from one department to another.

Work that is handled in the baskets is carried on the wire mesh conveyor to the inspection bench. An additional section for rinsing may be incorporated in this machine.

Fig. 3—A Ransohoff combination belt and monorail belt conveyor machine for washing and drying stamped steel parts.

Several improvements in Parker processes were made during the past year by Parker Rust-Proof Company, Detroit, Mich. The manufacture of automobile bodies of all-steel construction has made it possible to clean the bodies by forceful spraying of a cleaning solution onto the metal to remove all grease and foreign matter and then in a similar manner spraying a rustproofing solution onto the body in order to obtain a corrosion inhibiting and paint holding base. Figure 4 shows a view of an automobile body that has been subjected to a Bonderizing solution. The Parker process, known as "Bonderizing," found an increased use in the rustproofing of all-steel automobile bodies.

Another important use has been found for Bonderizing in the manufacture of steel windows. Figure 5 shows an illustration of steel windows being processed through a typical Bonderizing set-up. Added protection against rust and finish failure is now offered by many of the leading manufacturers in this industry. This offer has been made possible by the use of efficient and economical methods of cleaning, Bonderizing, priming and baking of the finish. In many cases, the procedure of cleaning, Bonderizing and painting is a continuous operation and thus speeds up production.

Bonderizing is now adaptable to either immersion or spray application with lower temperatures for the solution and at reduced time of processing. The chemical treatment obtained by Bonderizing converts the metal surfaces into a finely crystalline protective coating which inhibits corrosion and increases the adhesion of any applied paint finish. As paint is applied to a Bonderized surface, a portion of it flows into the interstices between the crystals and as it dries and hardens it is keyed to the metal.

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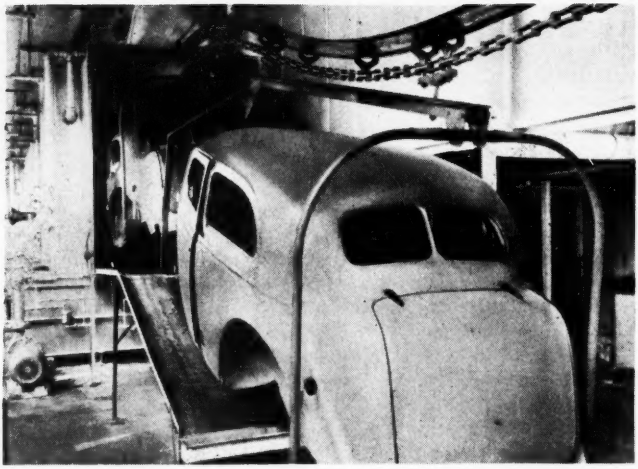

Fig. 4 — Illustration showing an all-steel body as it appears following the Bonderizing process.

ments in the field of plating was made by E. I. Du Pont de Nemours & Company, Inc., Wilmington, Del., in the new high-speed copper plating process. Heavy coatings of from 0.001 in. to 0.003 in. are said to be obtained in from 10 to 20 minutes, leaving excellent surfaces for direct deposition of bright or dull nickel. For articles such as printing rolls, wire and rods, the process may be adapted to a current density of 100 to 200 amperes per square foot.

The new process can be installed in the usual cyanide plating equipment. High purity copper anodes are required. The solution is readily prepared from pure compounds, which are completely and readily soluble in water. A 100 per cent cathode efficiency is said to be obtained up to 60 amperes per square foot and 100 per cent anode efficiency is obtained up to 30 to 40 amperes per square foot.

A very significant step in the plating field was made when the Bright Nickel Corporation, incorporated under the laws of the State of Michigan, acquired by purchase the American and Canadian patents for the bright nickel process. This corporation also purchased the patents and patent applications owned by the Pyrene Manufacturing Company, Newark, N. J., and Parker-Wolverine Company, Detroit, Michigan.

The bright nickel process is a well known and accepted method of nickel plating by which the materials come from the plating tanks with a bright, lustrous finish. They usually require no further finishing. Those companies representing the Bright Nickel Corporation are as follows: Harshaw Chemical Company, Cleveland, Ohio; McGean Chemical Company, Cleveland, Ohio; The Udylite Company, Detroit, Mich.; Pyrene Manufacturing Company, Newark; N. J., and Seymour Manufacturing Company, Seymour, Conn.

United Chromium, Incorporated, New York City, reported a growing number of installations for Electrolytic Color Plating. Electrocolor is the registered trade name used to designate the color finishes produced by Electrolytic Color Plating.

Electrocolor articles are now found commercially in automobile hardware, panels, escutcheons, costume jewelry, gift ware, lighting fixtures, and many similar applications where light fast, stable and brilliant colors of unusual hue are desired. It is possible with the use of Electrocolor to match and re-

produce shades uniformly in production.

A Zinc Dropping Test Set, illustrated in Fig. 6, whereby the thickness of electroplated zinc coatings can be determined by the Hull & Strausser method, was placed on the market by Hanson-Van Winkle-Munning Co., Matawan, N. J. The method used in connection with the test set is simple and requires only a few minutes to make a determination.

The test set consists of a reservoir which is filled with the proper test solution and two stopcocks that are provided which should remain open until all air is displaced in the delivery tube. The specimen to be tested should be cleaned by rubbing with a cloth moistened with trichlorethylene and placed 2 or 3 inches below the capillary tip at an angle of 45 degrees from horizontal. In operation, the lower stopcock is opened and the solution allowed to drop onto the specimen. The period required from the time the first drop touches the plate until the bare metal is exposed is measured with a stopwatch. Each second elapsing during the test represents a thickness of deposit of 0.00001 inch.

After the test is completed, the lower stopcock can be closed and the glass stopper placed in the burette. The solution in the glass tray is discarded, as it is advisable to make a single test only each time. The drop test method for zinc coatings is said to give an accuracy of within 10 per cent of the actual thickness of the deposit.

A chart printed in 14 colors showing how the Hydrion Wide Range pH Test Paper has been extended to include a color range for each pH unit throughout the range from pH 1 to pH 14 was issued by R. P. Cargille, New York City. Fourteen buffer solutions, one for each pH unit, are used to bring out on the test paper the characteristic color for any pH unit.

A simple comparator plate is included in each vial. This plate makes the color more vivid and is said to facilitate comparisons. Hydrion Test Paper is used like litmus paper and is said to give readings to well within 0.5pH units. The Hydrion method is said to be an extremely simple and economical method of pH control for analysis, product testing, and process control.

In addition to the pH papers, R. P. Cargille also developed an air-bubble method for determining the viscosity or "body" of varnishes and lacquers and also the equipment necessary for

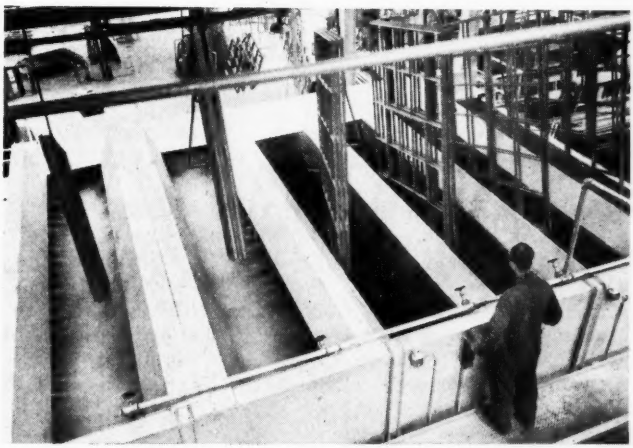

Fig. 5—A view of a typical all-steel window finishing set-up.

the test. An 8-page folder issued by the company goes into detail as to the background of the test, and also to the advantages of this method. The folder also lists a number of other laboratory devices of interest to chemists generally, as well as to paint and varnish workers.

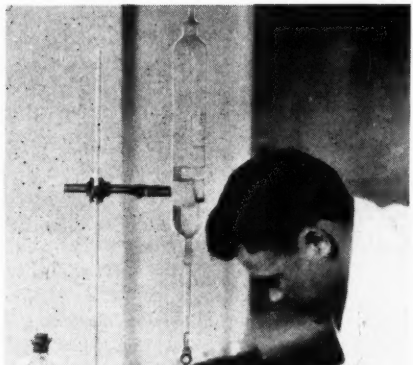

Fig. 6—Hanson-Van Winkle-Munning dropping test set for zinc coatings.

Kocour Co., Chicago, Ill., placed two analytical sets on the market for measuring and controlling the pH of solutions by the Colorimetric Comparator method. Illustration Fig. 7 shows the Comporator Set and Fig. 8 shows the Correction Set. These sets can be used for determining the pH of nickel, acid zinc, copper, cyanide, brass, and other solutions.

The use of these sets enables the electroplater to determine the pH of his solutions and then determine just how much acid or ammonia or other correcting medium should be added to change the pH to a desired point. This latter feature is said to be a time-saving convenience.

Adherence and satisfactory color of the plate and the avoidance of brittleness and pitting are dependent on maintaining proper pH. Nickel, unless properly deposited, will lift with subsequent chromium plating. The color obtained from brass solutions is dependent to a large extent on the pH. The Kocour sets are portable and can be operated at the tank. Anyone can use them after reading the instructions and the test requires only a minute or two to make.

The Comparator Set illustrated in Fig. 7 consists of a well-made hardwood box fitted with nine color standards having easy-to-read labels, a sealed tube of water, four graduated test tubes, a graduated dropping pipette, a bottle of indicator solution, a brush and complete instruction. The color standards will retain their proper color indefinitely if kept away from excessive heat and light.

The Correction Set which is illustrated in Fig. 8 consists of a cardboard case with two bottles of standard solutions and calibrated droppers. The sets illustrated are available with complete instructions for use.

During 1938, the engineering department of The United States Stoneware Co., Akron, Ohio, developed a new lining material for steel tanks which is marketed under the trade name of "Tygon." This lining material is said to be entirely resistant to attack by hot oxidizing agents, which quickly deteriorate rubber linings.

Tygon is said to be particularly well adapted for use as a lining material in pickling tanks that are used for pickling stainless steel. Tygon is a synthetic rubber which is entirely immune to attack by nitric acid. The construction of tanks with the use of Tygon necessitates the calendaring together of a number of fabric sheets

which have been thoroughly impregnated with Tygon. These sheets are then applied to the walls of the tank. The joints between lining sheets are welded together with strips of the same material as used for the main lining. A special adhesive has been developed to bond the lining to the tank walls.

Another lining material which can be applied in the field to large or small tanks that are used for plating, pickling or acid storage was also brought out by The United States Stoneware Co. and is known as "Ruplastoid." This type of lining is said to answer the demand for a relatively inexpensive lining material which is resistant to a wide range of plating and pickling solutions. The Ruplastoid lining is made of a thermo-plastic material which will not flow under heat and is said to be very resistant to cracking, even at low temperatures.

The material is available in several grades suitable for use from 200 deg. F. down. It is available in three forms —bulk, sheet or paste. The bulk material can be applied to cleaned surfaces by melting and pouring into place. The sheet material, which is available in thicknesses from ¼ in. to 1 in., can be cemented to the tank walls, and the joints between sheets heat welded with a blow torch. The paste form is a modified emulsion which can be trowelled onto the tank surfaces and sets to form a firm and flexible coating.

Another lining that was brought out by The United States Stoneware Co. is known as "Rubber-X." This type of lining can be applied by painting or spraying onto clean metallic surfaces. Rubber-X is a self-curing, pure latex emulsion. The linings for metal tanks can be built up by applying a number of films of Rubber-X, allowing sufficient time for drying between each application.

Coatings from 1/32 in. up to ¼ in. thickness can be applied to tanks and the finishing lining is a one-piece rubber membrane thoroughly bonded to the tank walls and resistant to all plating and pickling solutions.

Two types of stop-off lacquers were placed on the market by Michigan Chrome Company, Detroit, Mich. Illustration Fig. 9 shows a method of applying Miccro Supreme Stop-Off Lacquer. One of the stop-off lacquers is recommended for insulating plating racks used for decorative plating and the other for masking parts to be hard chromium plated. These lacquers can be applied directly to a metal surface with no treatment necessary other than a thorough cleaning of the surface to be coated.

Miccro Supreme Stop-Off Lacquers used for insulating plating racks are said to be practically unaffected when used in the regular cycle of decorative

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plating. Tests which have been conducted over prolonged periods with an alkaline cleaner at 212 degrees F. show that the coating was still effec-

Fig. 7—Kocour Comparator Set.

tive following 500 hours of continuous immersion.

These lacquers are said to be impervious to nitric and hydrofluoric acids and can be used where concentrated or diluted hydrochloric acid or sulphuric acid dips, cyanide or acid copper baths, standard or bright nickel baths, and chromic acid baths are used. In use with hard chromium plating processes, the Miccro Supreme Stop-Off Lacquers are said to permit thorough cleaning of all parts which have been plated. The lacquers are said to possess rapid air drying qualities.

Since the material used is absolutely neutral and not contaminated by acid or destructive substances, there is no possibility of etching of machined parts that have been precision finished during fabrication. These lacquers are recommended for coating permanent hard plating racks. Among other applications for these lacquers are their use for tank coatings, insulating busbars to prevent corrosion, protection of ventilating systems, and as a covering for water lines to prevent sweating or rusting.

An advancement in plating solution control was introduced by Platers Research Company, New York City. The methods of control recommended by this company are said to have simplified the analysis and maintenance of plating solutions. The methods are modifications of Dr. L. C. Pan's Simplified Methods of Analyses of Plating Solutions.

The chemicals used in the analyses are all specially prepared and sold in quart bottles. All the analyses are volumetric, and for the most part consist of two simple operations. All reagents are numbered for easy reference. Full directions and conversion tables and entry forms are supplied free with the purchase of reagents. Correction tables, which simplify the correction of a bath, are also supplied. Platers Research Company has also marketed reagents for the analysis of bright zinc, tin (stannate) and tin chloride, black nickel plating solu-

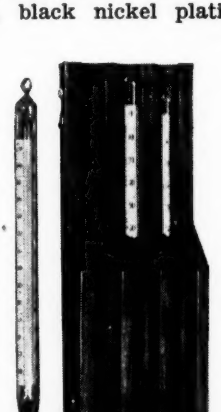

Fig. 8—Kocour Correction Set.

tions, boric acid in nickel plating solutions and acidity for low pH baths.

The Packer Machine Company, Meriden, Conn., brought out an auto-

matic polishing and buffing machine designated as the "No. 2 Straight Line Conveyor Type Polishing and Buffing Machine." This unit was designed for the finishing of a variety of small parts. This machine is of the conveyor type and employs a new style of exterior design, namely that of shielding against abrasive dust. The general appearance as shown in Fig. 10 is smooth and graceful, with only the hand wheel controls projecting from the body design.

The size of the No. 2 Straight Line Conveyor Type machine is 30 ft. 6 in. long and 4 ft. 6 in. wide. The machine is designed so that any number of wheelheads, depending upon the requirements, can be used. The wheelheads are known as the Packer No. 6500 Universal Type, with adjustments for setting the wheels at any angle from horizontal to vertical or to any angle within 90 degrees. The wheelheads are arranged with spring balance plates, thus providing a flowing action to the wheels to compensate for any lack of uniformity in thickness of the part to be finished and also permitting the finishing of work in various thicknesses.

The wheelheads can be furnished with motors of various horsepower, depending upon the customer's requirements, and are also supplied with direct driven wheels or multi-"V" belt driven wheel spindles which are said to permit changing the speed of the wheels necessary for various metals and finishings. The adjustment device for the changing of the position of the wheels is mounted on the front side of the conveyor, thus permitting the operator to adjust each wheel according to his requirements from the working station or the operating position of the machine.

The conveyor chain is driven by a variable speed unit which permits changing of the speed of the conveyor by adjustment of a control on the drive unit itself. The changing of the speed can be done very quickly by the operator. All important moving parts are constructed with ball bearings. The carriers to which the work holding fixtures are fastened travel on a solid machine surface track and each carrier is equipped with grease sealed, dust-proof, ball bearing rollers. All working parts of the machine are shielded against dirt or abrasive material coming in contact with moving parts.

Two types of abrasives were placed on the market by M. P. Iding Disc Grinding Compound Co., Milwaukee, Wis., one known as "Idilite" and the other as "Idilon." Idilite is an aluminum oxide abrasive and Idilon is a silicon carbide abrasive.

Idilite, the aluminum oxide abrasive, is available in two types — the

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ET and the NT. The ET type or etched grains are said to possess very high capillarity and extraordinary sharp cutting qualities. The NT type or non-etched grains are said to possess long wearing qualities which

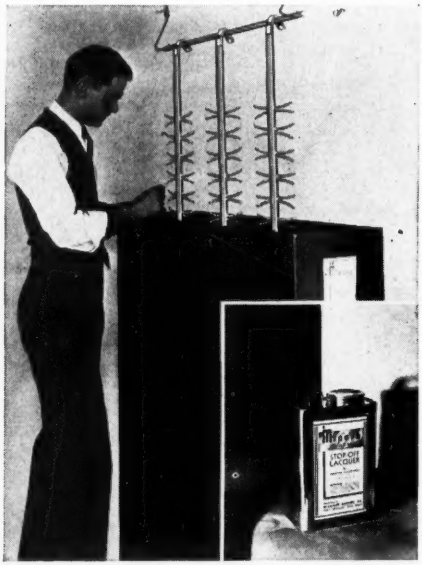

Fig. 9—Illustration showing the manner in which Miccro Supreme Stop-Off Lacquers can be applied.

have been observed to produce a very bright finish when used with cement.

Idilon, the silicon carbide abrasive, is adapted for special use and is said to give exceptional results when used to polish gray iron of all kinds. This type of abrasive is available in grains in any size or type from pound lots to carloads.

A cold adhesive for polishing wheels to be used for polishing brass, known as "Brass Grade Nuglu," was developed and placed on the market by J. J. Siefen Company, Detroit, Mich. This adhesive is said to be the only one that can be used cold for brass work. The technique of using Brass Grade Nuglu is slightly different from that which is generally used but it is not any more difficult than the regular method. Wheels set up with Brass Grade Nuglu are said to provide a means for obtaining a beautiful finish.

In the field of metal finishing, Newcomb-David Company, Detroit, Mich., introduced a water type spray booth which is known as the "Torrent Type." This type of spray booth is of special construction and is said to incorporate a new principle of operation. An illustration of this spray booth is shown in Figure 11. It is said to be economical in average production use and requires but a minimum horsepower for operation.

In the Torrent Type Spray Booth, the water is drawn from a sludge tank and pumped to a horizontal pipe located near the top of the booth. The water pours in a steady volume from the pipe into a trough which deflects one-half of the water into a cleansing chamber located at the back of the booth and the other half over the water curtain which flows behind the object being sprayed.

A positive suction fan above the booth carries the paint and fume-laden air and a large volume of water which is entering the sludge tank from the water curtain, into the cleansing chamber. As the air and water are drawn up into this chamber, they meet a cascade of water pouring from the pipe and trough at the top, with the result that a violent churning of air and water is developed in the chamber. Because of this churning action, the air is thoroughly cleansed before it reaches a set of eliminating plates in the top of the booth and the fan in the exhaust stack.

As paint is sprayed against the water curtain located at the rear of the booth, it is immediately carried

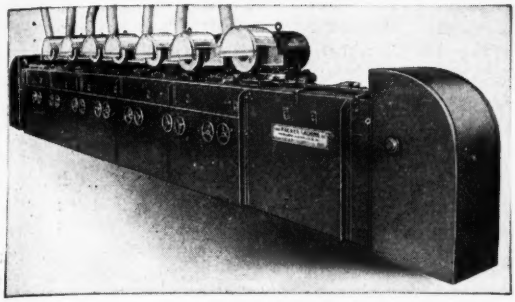

Fig. 10—Packer No. 2 Straight Line Conveyor Type Polishing and Buffing Machine.

downward into the sludge chamber at the base of the booth. Thus, no paint accumulates on the walls or back of the booth, and that which is deposited in the sludge tank can easily be removed for reclaiming.

A porcelain-like, short bake, synthetic enamel known as "Vitra-Carlite" was placed on the market by Hilo Varnish Corporation, Brooklyn, N. Y. This material is said to cover excellently in one coat when applied with a full smooth film. It may be used for brush, spray, dip or tumble application. Vitra-Carlite Quick-Baking Synthetic is said to have excellent hardness and mar-proofness. It has chemical resistance, especially to solvents, oils, greases, and so on.

New Wrinkle, Inc., Dayton, Ohio, published several issues of their house organ, "New Wrinkles in Finishing," which deal exclusively with the possibilities of wrinkle finish and its sales influence on consumer products of every description. These booklets describe in detail the merits of New Wrinkle as an economical one-coat finish which produces striking effects at maximum finishing economy.

A tumbling machine known as the "Munning Improved Type" Tumbling Machine as illustrated in Fig. 12 was placed on the market by Munning & Munning, Inc., Newark, N. J. This machine is available in single and multiple units with tubs of standard size for either belt or direct connected motor drive. The drums are made from high grade cypress, maple or oak panels, and are snugly fitting into cast aluminum heads with a friction cover which can be quickly fitted or detached.

The simplicity and versatility of this machine, due to the accessibility of all its parts, renders it highly effective for either wet or dry tubbing of articles of the following type: chains, tubes, cups, pins, studs, pens, optical goods, jewelry, safety razors, novelties, curtain rods, dental tools, surgical instruments, watch crowns, household fixtures, ring settings, eyeglass frames, purse frames, and so on.

The frame of the Munning Improved Type Tumbling Machine is of all-welded construction and the tubs are revolved through miter gears and a spiral jaw clutch which can be easily engaged or disengaged at will.

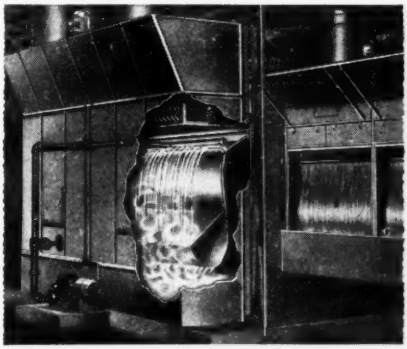

Fig. 11—Newcomb-David Torrent Type Spray Booth.

Each drum may be operated independently of the others and if occasion arises to remove a drum from the machine, it is simply necessary to lift it out of its bearings without dismantling any parts or disturbing the balance of the apparatus in motion.

Loading of the Munning Improved Type Tumbling Machine is accomplished through a hopper arrangement placed over the drums while in the stationary position, and in unloading, the barrel is simply inverted for discharge while the work empties into a double tray of the drawer type as shown in the illustration. The inner tray of this combination retains the finished work while the outer tray, which has a finer screen, retains the burnishing balls. The inner tray, being slightly shorter in length than the outer one, may be shaken back and forth for complete separation of the work from the balls before complete removal from the machine. In wet tumbling, the liquid used during the operation can pass through a screened drain in the bottom of the machine.

A one-coat bake finishing material that looks, feels and wears like porcelain, and marketed under the name of "Porcenite," was placed on the market by Advance Paint Company, Indianapolis, Ind. Porcenite is said to be resistant to water, soaps and alkalies and is a finish particularly well adapted for use on various household appliances including washing machines, ranges, refrigerators, and so on.

The white Porcenite is said to have remarkable resistance to yellowing. Baking temperatures will vary according to the time allowed in the oven. For light gauge metal, the suggested schedule is 200 degrees F. for one hour or 300 degrees F. for 45 minutes. The finish is hard when it leaves the oven. Porcenite is available in white, black and a variety of colors.

Many new developments in finishing material application are described in the catalog that was issued by Paasche Airbrush Co., Chicago, Ill., entitled "Profit with Paasche Air Painting Equipment." The 48-pages of this catalog contain many of the new and interesting developments that were placed on the market during the past year. All of the items described are fully illustrated.

A primer for untreated Dowmetal was placed on the market by Watson-Standard Company, Pittsburgh, Pa. The development of this primer covers each series of primers for use on both treated and untreated Dowmetal, whether they be baking or air drying types. The Watson-Standard series of primers were developed to provide an improved, protective base coatting and are said to provide excellent adhesion, general workability, compatability

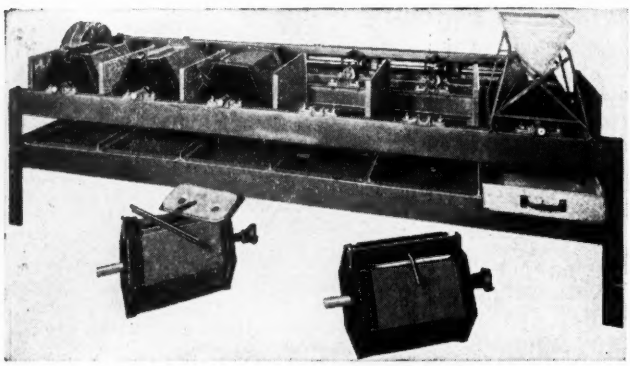

Fig. 12 — Munning Improved Type Multiple Unit Tumbling Machine.

with finishes, and weathering resistance.

Ault & Wiborg Corporation, Cincinnati, Ohio, introduced a new industrial finish which attains the production speed of lacquers and possesses the desirable qualities of permanence and durability common to synthetic resin finishes marketed under the trade name of "Polymerin." This product is said to be the result of a distinctive formulation. Its action is due to the principle of polymerization, a chemical reaction whereby molecules combine under suitable conditions to form molecules of more complex and stable structure. Polymerin does not dry by oxidation.

Oven temperatures and the mass of metal to which the new finish is applied determine the processing time, which varies between a few minutes and a few seconds. Only one bake is required. Polymerin provides a suitable finish for washing machines, office equipment, metal furniture, toys, stoves, hospital equipment, plant machinery, electrical appliances, and other types of metal products.

Polymerin handles in much the same manner as other finishing materials inasmuch as it sprays freely and can also be used in the dipping process. Polymerin is said to set-up so rapidly that a dust-free surface is the result. It will not collect foreign particles floating in the air either before or during polymerization.

A very efficient and economical means of dust control with the use of a "Hydro-Foam" Dust Collector was developed and placed on the market by R. C. Mahon Company, Detroit, Mich. Illustration Fig. 13 shows a view of a standard unit Mahon Hydro-Foam Dust Collector. This type of dust collector is said to employ an entirely new principle of dust removal and collection, since it has no cloth screens, no water pumps, and no nozzles or jets. The only moving mechanism in the entire system is a suction fan which is located on the outlet side and handles only clean air.

The system is entirely pneumatic. The liquid solution is maintained at

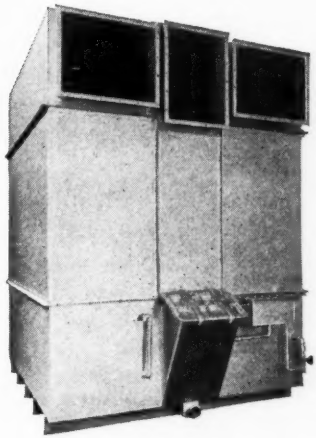

Fig. 13—Illustration showing a standard unit Mahon Hydro-Foam Dust Collector.

the proper level automatically. The Hydro-Foam dust eliminating process is achieved through the use of air on the surface of the solution and in the Hydro-Foam chambers. The dust is removed from the air and retained in the collector in the form of a sludge, which can be removed either manually, through a clean-out door, or automatically by means of an inclined screw conveyor.

The Mahon Hydro-Foam Dust Collecting units are manufactured in standard sizes of various capacities and can be used in single or multiple to meet any industrial requirements.

C. W. Haynes Laboratories Inc., Springfield, Mass., introduced a line of finishes which were marketed under the name of "UltraKote." LoBake UltraKote is said to be an extremely

hard, tough, flick-proof and lustrous finish which bakes at 150 degrees for one-half to one hour. This finish resembles porcelain in appearance and resistance to solvents. It will adhere

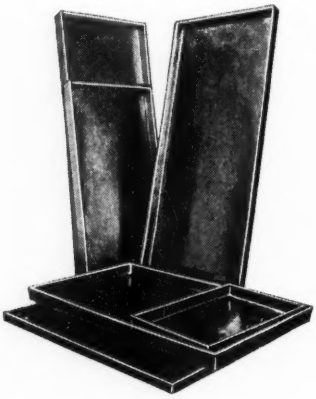

Fig. 14—Haveg Drying Trays.

to brass, steel, zinc die castings, and other metals. The finishes available are porcelain white, clear and a range of colors.

LoBake UltraKote is said to have unusual build and depth of film. This type of finish is available in brilliant metallic effects that are resistant to perspiration, burning alcohols and cigarettes.

HiBake UltraKote bakes as short a time as 30 seconds at 1,000 degrees F. and at all temperatures down to 150 degrees F. for one hour. This finish is produced in a white that is said to resist yellowing at elevated temperatures for long periods of time. It is also said to have unusual resistance to solutions with as high as 3 per cent caustic.

UltraKote Baking Undercoat is a finish for use under UtlraKote Urea Formaldehyde finishes. This undercoat air dries rapidly to take a top coat of Urea Formaldehyde finish and then both coats can be baked in one firing. UltraKote Baking Undercoat is said to provide perfect adhesion and also a maximum bond between the top coat and the metal.

The drying trays illustrated in Fig. 14 were placed on the market by Haveg Corporation, Newark, Del. This type of drying tray is said to be a standard item and is available in practically any size as standard. Haveg Drying Trays are said to provide excellent service for the drying of acid reagents and similar product. Crystals separate easily from the trays and the low co-efficient of heat transfer of Haveg facilitates even drying. The trays can be used at temperatures up to 265 degrees F. without fear of damage.

The Porcelain Enamel & Mfg. Co., Baltimore, Md., brought out several improved enamel frits and processes. This firm has developed and introduced to the trade two new ground coat frits which, when used together, are said to give an unusually long burning range together with freedom from copperheads and other ground coat defects.

Their line of Super Opaque Enamels was increased from three to seven, giving a maximum opacity. A single frit or a combination of these frits are suitable for every need. A Clear Cover Coat Enamel which is said to have been improved to give not only brighter and clearer colors, but greater freedom from scumming, hairlining and other defects often encountered with this type of enamel was also introduced to the trade.

Acid Resisting Enamels have been improved to include acid resisting enamels which combine to superacid resistance and working qualities of the older Pemco acid resisting enamels, with greatly increased opacity. Pemco has placed added impetus into its work in the develop-

ment of special acid resisting enamels for architectural use, and is now able to supply enamels of this type suitable for use in all color combinations, both in the glossy and satin finish.

Pemco Cleaner was also introduced to the poreclain enameling industry. This cleaner can be used for removing mineral or vegetable oils from sheet iron commonly used for stamping or drawing operations. The cleaning action is obtained by emulsification.

A One-Fire Finish was also placed on the market by The Porcelain Enamel & Mfg. Co. This finish has a good lustre, is attractive in appearance, can be sprayed over the bisque ground coat and is obtainable in one fire. Pemco One-Fire Finish was developed principally to give a low cost finish of a durable character for inexpensive merchandise.

Stanley Electric Tool Division, The Stanley Works, New Britain, Conn., issued a catalog describing Stanley grinders, flexible shaft grinders, sanders, portable electric disc sanders, and which was designed as Catalog No. 65. The Stanley Electric Tools are said to be mechanically and electrically correct. Before leaving the factory, all tools, in addition to careful inspection, are subjected to a long running test and all electrical parts and connections are subjected to a 900 volt test for grounds. Stanley Electric Tools will operate satisfactorily on voltages 5 per cent over or under voltages specified.

Roxalin Flexible Lacquer Company, Elizabeth, N. J., placed on the market a clear lacquer designed for the maximum protection of brass and bronze, brass plated steel and brass plated castings to be known as the "No. 2275-A." In practical and accelerated tests designed to prove the prevention of spotting and protection against tarnishing in exposure to moist hydrogen sulphide, salt spray, humidity and perspiration, Roxalin No. 2275-A is said to provide a degree of durability hitherto obtainable only with clear synthetics requiring a bake of 275 to 300 degrees F. Roxalin No. 2275-A may be applied by dip or spray and is sufficiently flexible to permit blanking and forming of prefinished metal where this is desirable or required.

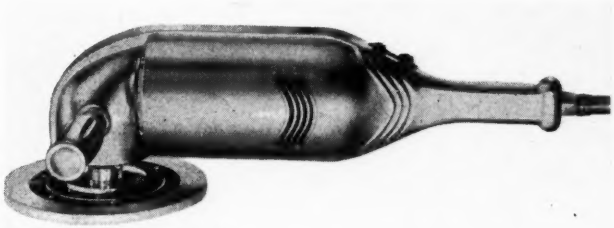

Fig. 15—Skilsaw Model N Special Duty Disc Sander.

A textured enamel for wrinkle finishes, to be known as "Rincon-Trol," which is said to possess high decorative values, was also placed on the market by Roxalin Flexible Lacquer Company. Uniformity of finish without glossy spots or fish eyes, perfect texture formation and uniformity of repair by respraying are qualities ascribed to it. The final finish is highly resistant to marring, moisture, perspiration and abrasion, and when properly baked, cannot be damaged except by mechanical means. Rincon-Trol is available in all colors except white—ivory is the lightest color.

Skilsaw Inc., Chicago, Ill., introduced three models of the Skilsaw Disc Sander. Illustration Fig. 15 shows one of the models of the Skil-

saw Disc Sander. These sanders are used on practically all types of metal operations.

The model of the disc sander required of the three models built is determined by the nature of the work and the amount of work. These sanders are applicable for removing spot welding marks, for touch-up work on clean metals or removing paint, lacquer or enamel from a metal surface. There is a unit available for intermittent or continuous operation.

When a Skilsaw Disc Sander is used for removing weld marks, for cleaning up new metals or for removing paint, lacquer or enamel from a surface, the ordinary pad equipped with sanding discs is used. If raised welds are to be ground, the pad on the machine can be removed and a cup wheel used in its place.

A Double Cartridge Respirator designated as "DC-4100" was placed on the market by Pulmosan Safety Equipment Corp., Brooklyn, N. Y. The Pulmosan DC-4100 Double Cartridge Chemical Respirator was designed for

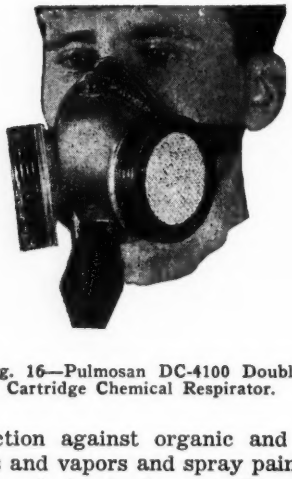

Fig. 16—Pulmosan DC-4100 Double Cartridge Chemical Respirator.

protection against organic and acid fumes and vapors and spray painting. This respirator is shown in Fig. 16.

By its use of two chemical cartridges this type of respirator is said to afford maximum protection for a

Fig. 17—Pulmosan R-151 Chemical Respirator.

long length of time. The breathing resistance of the unit is low. The body of the respirator is all aluminum, which is said to afford lightness and strength. It has an all-rubber face cushion for comfortable, air-tight seal. A positive exhalation valve removes all exhaled air.

The Pulmosan R-151 Chemical Respirator is a single cartridge unit designed for protection against organic and acid fumes and vapors in spray painting which is shown in Fig. 17. This respirator features an additional, outer dust filter added to the chemical cartridge. By means of this filter, particles are prevented from clogging the chemical cartridge, thus giving additional protection against dust and also lengthening the efficiency of the cartridge. This feature is said to be very valuable in spraying painting and in atmospheres containing fumes and dust particles. The R-151 model is made with an all-aluminum body, and patented rubber face cushion. The unit is light in weight, comfortable to wear and easy to breathe through.

Several improvements in develop-

ments during the past year were announced by Maas & Waldstein Company, Newark, N. J. One of these was a lacquer finish in white, and pastel shades. Finishes of this type are marketed under the trade name of Duart Wrinkle Enamels, and are supplied in every color including white and pastel shades.

These enamels bake hard and are wear-resistant with a short baking schedule. The final finish is said to have uniform wrinkling without glossy spots, shiners or fish eyes. Practically no discoloration takes place during baking. Duart Wrinkle Enamels are light in body and can be sprayed in the same manner as synthetic enamel. Patterns can be varied from fine to very coarse and only one coat is required.

A perspiration-proof lacquer known as "Dulac" was also placed on the market. This type of finish is an air drying lacquer which, if hardened for a few days, becomes practically insoluble and resistant to moisture, soap and water, and perspiration. This type of finish is suitable for all metals including steel.

A synthetic enamel known as "Polydur" that is said to give an excellent finish with a short, high temperature baking schedule was also placed on the market by Maas & Waldstein Company. This high speed synthetic enamel affords a heat resisting finish following a baking schedule.

In the tumultuous rush of modern life the mental stimulation and satisfaction that are to be derived from symmetrical design and the use of color and bright metal finishes are becoming increasingly important. The year 1939 will see a very definite advance in the field of metal finishing.

Dockson Model "38" Regulator. C. H. Dockson Company, 2885 E. Grand Blvd., Detroit, Mich., is now issuing a folder describing the new Model "38" Regulator for reducing and stabilizing air pressures. This regulator is made possible by the patented Dockson process of die casting alloys into finished regulator parts.

Precision and savings in manufacture can be effected through the reduction and stabilization of air pressures through the application of apparatus for control of air pressures.

There are two standard models available, namely the No 38S and the No. 38R. Gauges may be installed in all regulators, a double outlet may be provided if desired, special brackets may be attached, a permanent adjustment device may be incorporated or ⅛ in. pipe thread connections may be furnished. Copy free upon request.

"For Cleaner Frit." This is the title of a 6-page folder illustrating and describing the new Pemco Bag now being issued by The Porcelain Enamel & Mfg. Co., Pemco and Eastern Aves., Baltimore, Md. Pemco porcelain enamel frits, packed in this newly engineered container, are said to be the last word in frit manufacturing.

Six of the outstanding features of the new Pemco Bag are as follows: same size end to end, stack and store like boxes, speed up taking of inventory, easy to open, sewed top and bottom, and elimination of danger of moisture soaking the bag open.

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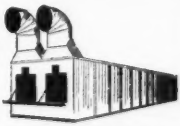

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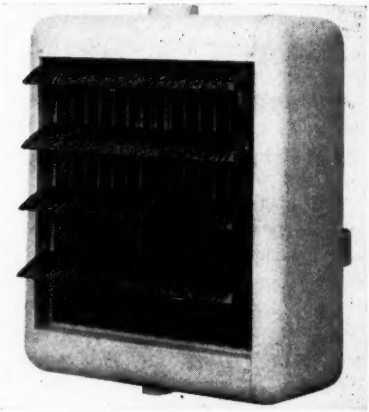
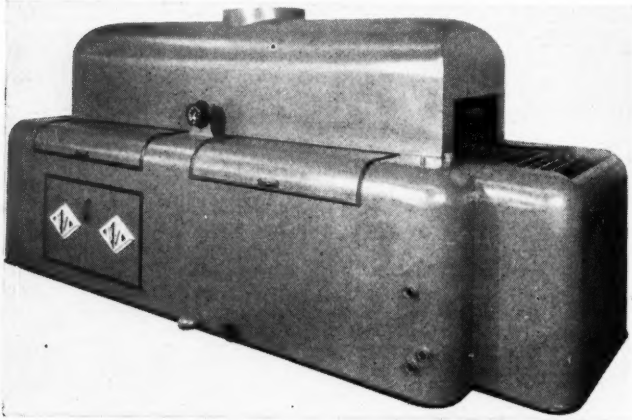


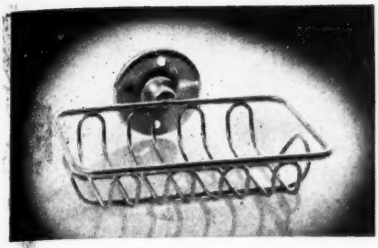
(Right) — This industrial heater is "dressed" in a sturdy art-metal finish that can be applied on castings or stampings. This type of finish requires no filler undercoat, covers in a single coat, and bakes to a fine, perfect texture even on corners and beads.

(Photo Courtesy Sherwin-Williams)

(Photo Courtesy International Conveyor and Washer Corp.)



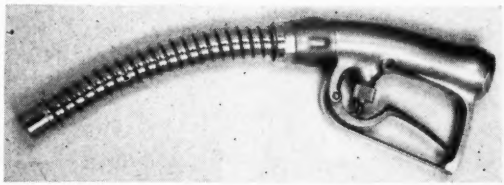
(Left)—All extruding parts such as pipes, motors, pumps and structural members are hidden from view on this industrial washing machine and only clean, smooth painted outside surfaces proportioned in accord with the best thought in modern machine design present themselves.



(Photo Courtesy The Udylite Company)

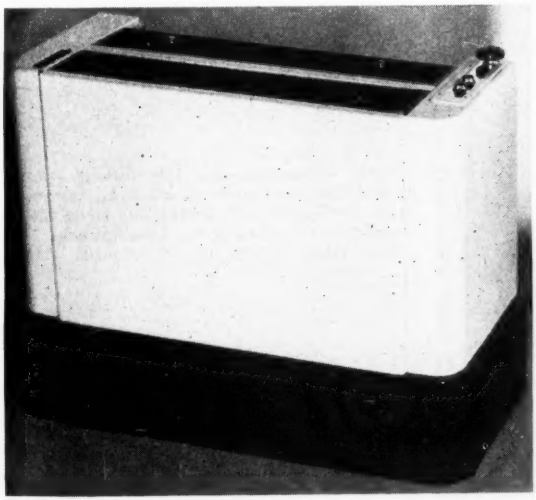
(Left)—The inexpensive wire soap dish illustrated herewith is copper flashed and bright nickel plated directly on unburnished steel. The finishing operation is simple and ecomonical due to the fact that no pre-plating polishing is necessary.

This streamlined aluminum alloy gasoline hose nozzle is designed and constructed to fit in with modern gasoline station appearance. The body is finished in Indurite to resist abrasion, weathering, perspiration, and grease and gasoline stains. The flexible metallic spout and other accessories are finished in polished chromium.



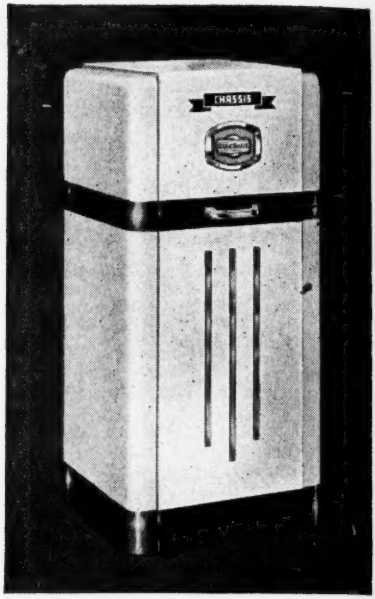
(Photo Courtesy Scovill Manufacturing Company)

(Photo Courtesy Maas & Waldstein Company)



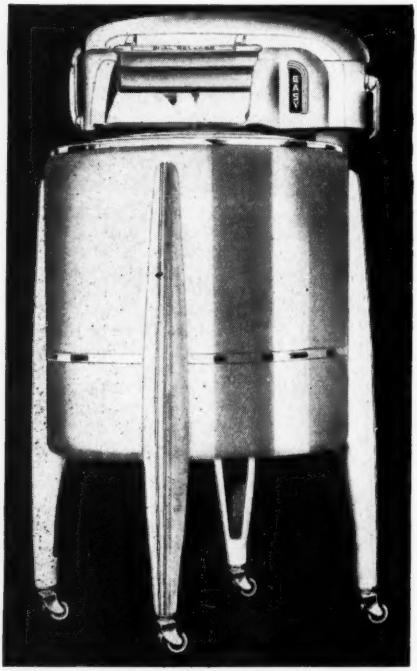
This ivory and black "Chatelaine" air-conditioning unit, product of Standard Air-Conditioning, Inc., is built of steel stampings. The stampings are degreased and Bonderized and then covered with a spray coat of M & W Durad neutral baking primer, which is baked one hour at 350 degrees F. The cabinet is then given a spray coat of eggshell baking enamel, which is baked at 300 degrees F. for one hour. The apron is sprayed with Durad gloss black baking enamel which is also baked at 300 degrees for one hour.

(Right)—This chassis lubrication dispenser is finished with a baked white enamel finish over primer and Metalprep. The base band is black and the midway band is red. The lettered banner is applied by a silk screen process. The handles and vertical front stripes are chromium plated.

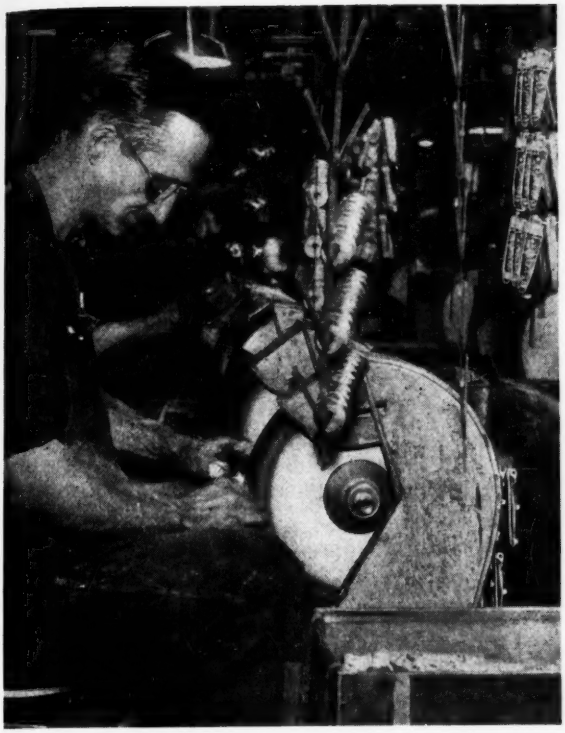


(Photo Courtesy The Cincinnati Ball Crank Co.)

(Photo Courtesy Easy Washing Machine Corp.)



(Left) — Underneath the baked enamel finish of this modern washing machine, the surface of the metal has been chemically rust proofed by Bonderizing. All decorative beading is chromium plated.



On the High Production Jobs . . .

ALUNDUM ABRASIVE

WHEN conveyor systems are feeding parts to the polishers, only a high production abrasive can be used—no tie-ups can be tolerated.

And it's on such jobs that Alundum Abrasive is popular. Special shaping operations in its manufacture assure a fast cutting grain. Special surface treatments give high capillarity —extra sticking power so the grain stays on the wheel until its full job is done. You can depend on Alundum Abrasive to keep pace on your high production jobs.

NORTON COMPANY, WORCESTER, MASS.

G-83

NORTON ABRASIVES

NEWS of the Industry

Milburn Company Appoints Detroit Representative

The Alexander Milburn Company, 1436 W. Baltimore St., Baltimore, Md., manufacturers of spray finishing equipment, cutting and welding apparatus, has announced the appointment of Frank P. Snyder as sales representative in Detroit, Mich. According to the announcement, Mr. Snyder has wide experience in the design, sales and installation of spray finishing equipment.

Behr-Manning Awards

On Thursday, December 22nd, at their headquarters at Troy, N. Y., Behr-Manning Corporation, manufacturers of coated abrasives, presented to two hundred fifty-six employees awards for long service: gold for eighteen who had served twenty-five years or more, silver for one hundred thirteen whose service ran between fifteen and twenty-five years, and bronze for one hundred twenty-five whose employment was for between ten and fifteen years.

For those in the twenty-five year c'ass. there were in addition to the award a gold button and a gold embossed certificate, suitable for framing. Similar buttons and certificates in silver and bronze were presented to the fifteen and ten-year candidates. This follows closely the plan that has been pursued for many years by Norton Company of Worcester, of whom Behr-Manning Corporation is a Division. Of the group, one hundred forty-four were employees in the manufacturing departments and one hundred twelve from the sales and office.

Lewis B. Swift Appointed President of Taylor Instrument Companies

According to a recent announcement, Mr. Lewis B. Swift will succeed Mr. Herbert J. Winn as president of Taylor Instrument Companies, West Ave. and Ames St., Rochester, N. Y. Mr. Swift joined the Taylor Instrument Companies in 1904 after graduation from high school. In 1908 he entered Cornell University and after receiving his M. E. degree in 1912, he rejoined the company.

In 1928 Mr. Swift was elected director of the company and in 1929 he became chief engineer. Since 1934 he has been vice-president in charge of engineering research and design.

Appointment Announced

The appointment of A. J. Hazlett as manager of the Strip-Steel Department of the Jones & Laughlin Steel Corporation, Pittsburgh, Pa., has been announced recently. He succeeds William Miller, who was recently appointed District Manager of the company's Detroit office.

Mr. Hazlett has been president of the Eastern Rolling Mill Company, Baltimore, Md., since 1937. His entire business experience has been in the steel business.

Spooner Appointed Manager of Industrial Sales for Berry Brothers

According to a recent announcement, Mr. C. E. Spooner was appointed mana-

ger of the Industrial Sales Division, Berry Brothers, Inc., 211 Leib St., Detroit, Mich. Mr. Spooner became asso-

C. E. Spooner

ciated with Berry Brothers eight years ago as an industrial salesman in New England.

Pyramid Metals at New Location

According to a recent announcement, Pyramid Metals Company, manufacturers of Snap-On and decorative mouldings, has moved to a new modern factory at 1335 N. Wells St., Chicago, Ill.

Hilo Industrial Finishes Exhibit

The illustration herewith shows a view of the Hilo Industrial Finishes Exhibit as presented at a recent purchasing agents' convention which was held at the Hotel Pennsylvania, New York, N. Y. Hilo Industrial Finishes are manufactured and marketed by Hilo Varnish Corporation, 42-60 Stewart Ave., Brooklyn, New York.

View showing Hilo Industrial Finishes Exhibit as it appeared at the purchasing agents' convention at the Hotel Pennsylvania.

Paramount Rubber Service, Inc.

According to an announcement made recently by H. Tom Collord, President, Collord, Inc., 7049 Lyndon St., Detroit, Mich., Paramount Rubber Service, Inc., 1430 Rosedale Court, Detroit, Michigan, was formed to take over the following departments from Collord, Inc.; one, the dip department, which is devoted to rubber coating of metal units of every description; two, the S R L Department, home of the famous seamless-rubber-lined tanks; and three, Surfaseal Rubber Paints, which includes a complete line of rubber protective coatings.

Barton Appointed Assistant Manager of G-E New York District

The announcement was recently issued by the General Electric Company, Schenectady, N. Y., that Mr. T. F. Barton, district engineer of the New York district, had been appointed assistant manager of the New York district.

Mr. Barton has twice won Charles A. Coffin Foundation awards for outstanding contributions to the electrical industry. He is a fellow of the American Institute of Electrical Engineers and former chairman of the metropolitan section of the organization.

Mention PRODUCTS FINISHING when writing to advertisers. Your co-operation will be appreciated both by the advertisers and this magazine.

NEW Plant equipment and MATERIALS

Maas & Waldstein Spray-Booth Compound

A spray-booth compound which is said to facilitate cleaning of spray booths and help to reduce both fire hazard and marring of finished work has been developed and placed on the market by Maas & Waldstein Company, 438 Riverside Ave., Newark, N. J.

The Maas & Waldstein Spray-Booth Compound makes the cleaning of a spray booth a simple matter. Before the spraying operation on workpieces is begun, all exposed surfaces of the booth are covered with the compound, which is a non-hardening, non-oily paste which can be applied with a brush. The residue from the sprayed lacquer, paint or enamel are deposited on the compound. When it is desired to clean a booth, the compound and the residue are easily and completely removed with a putty knife and without using an inflammable solvent.

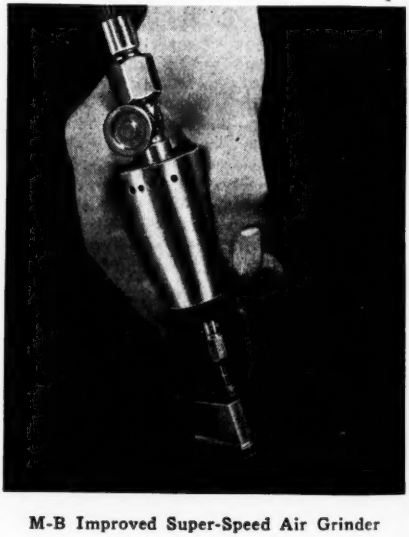
M-B Improved Super-Speed Air Grinder

The illustration shows an air grinder which has been placed on the market by M-B Products, 126 E. Larned St., Detroit, Mich. This unit is known as the "M-B Improved Super-Speed Air Grinder."

The M-B Super-Speed Air Grinder is of steel construction throughout and is said to be especially useful for finishing in deep cavities and hard-to-get-at places. The air to the grinder is controlled by a positive, quick acting valve.

The spindle is of heavy construction, heat treated, and ground to close limits. The unit is equipped with ball bearings which are of the Bakelite retainer self-aligning type, rigidly held on the spindle.

The M-B Improved Super-Speed Grinder is recommended where a combination of speed, power, precision and efficiency are required. The mounted grinding wheels that are used operate at



M-B Improved Super-Speed Air Grinder

unusually high speeds and assure fast work and clean-cut areas. An air filter in the hose line protects the working parts from dirt and abrasive dust. This type of air grinder is available with spindles to accommodate mounted grinding wheels, cutters, rotary files, and so on with ⅛ in. or $\frac{1}{16}$ in. shanks.

The M-B Improved Super-Speed Air Grinder units are packaged in cases with a hose line 7 ft. long, and fitted with dirt filter, two wrenches and four mounted grinding wheels.

Natrolin B-4 Chrome Cleaner

A cleaner for use following nickel plating and prior to chromium plating, to be known as "Natrolin B-4 Chrome Cleaner," has been placed on the market by Sulphur Products Company, Inc., Greensburg, Pa. This cleaner is said to eliminate the "smoky finish" that is sometimes found on finished chrome work.

Natrolin B-4 Chrome Cleaner is prepared so that it will function immediately after the cleaning solution is made up. It is stated by the manufacturer that it will not oxidize or tarnish the nickel coating. It is capable of operating at temperatures of 170 deg. to 212 deg. F. and is free rinsing.

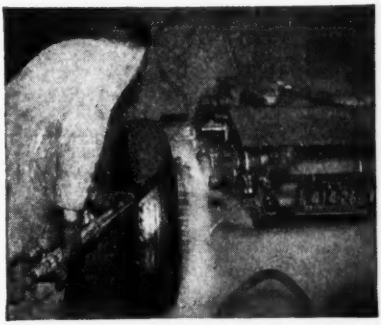
The use of Natrolin B-4 Chrome Cleaner is said to bring about a chrome plate which is both lustrous and clean and one which requires no buffing prior to assembling and packing.

Oakite Steam Gun

A steam gun which was developed especially to meet a demand for a speedy, effective means of removing heavy accumulations of dirt, grease and oil deposits from all kinds of industrial machinery and equipment has been announced by Oakite Products, Inc., 20 Thames St., New York, N. Y.

A basic principle of the Oakite Steam Gun is a self-lifting feature. This gun automatically lifts the cleaning solution from floor level to a height of over 10 ft. without the aid of pumps, injectors, or other auxiliary apparatus. The necessary provisions for operating this type of gun are steam, solution hoses, and an open top drum out of which the cleaning solution can be drawn.

The Oakite Steam Gun is available in two different sizes to meet various requirements. A small unit, designated as No. 384, is 3½ ft. overall length and weighs 5¾ pounds. It is equipped with an air-cooled handle and is designed for cleaning machinery, equipment, and so on.



Oakite Steam Gun

A large unit, designated as Model No. 385, is 7½ ft. overall length and weighs 13¼ pounds. This unit is designed for heavy duty steam cleaning operations and where a long gun is required for cleaning high objects.

Rubprotex Coating Material

A rubber-base film for metal surfaces, to be known as "Rubprotex," has been placed on the market by Rubprotex Company, 122 Pearl St., Buffalo, N. Y. Standard application can be made by brushing in a manner similar to the application of paint. This material is also available for spraying applications when specified. The available standard colors of Rubprotex are gray, red, green, orange and white. Coverage on a metal surface is 300 to 375 sq. ft. per gallon. The material resists dry heat to

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a maximum of 300 degrees Fahrenheit.

The application of a coating of Rubprotex results in a dense film which is said to resist attack by acids, alkalies, oils, smoke, corrosive gases, weather and shock.

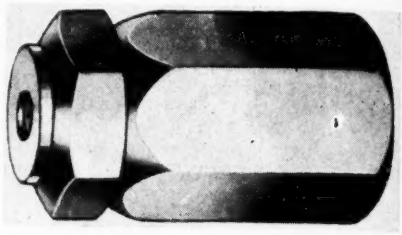
Republic Reflectometer

A test unit which compares surface reflection with set standards, to be known as the "Republic Reflectometer," has been placed on the market by Republic Chemical Machine Co., 154 Nassau St., New York, N. Y. Inside the housing of the Reflectometer is an adjustable holder on which a test piece whose surface is to be measured can be mounted. The piece can be mounted at a variable angle to reflect light from an adjustable light source upon a photocell. The Reflectometer is suitable for establishing standards of gloss, reflection or for color matching. The current for operation can be taken from a 110-volt source.

Intensity of the light can be set by means of a resistor. The photocell is wired to a voltage amplifier to produce a signal that is delivered to the grid of a cathode-ray tube. This tube, wired for a spread of 90 deg. in its signal angle, is closed to zero degrees by varying the intensity of the light. Voltage at this point is read on a meter on the face of the housing. Comparison is made from this reading and the one obtained from a standard test piece in order to compare reflectivity with the standard surface.

Spraying Systems Atomizing Nozzle

An atomizing spray nozzle for humidifying various industrial and chemical processes has been placed on the market by Spraying Systems Co., 4922 W. Grand Ave., Chicago, Ill. The spray



Spraying Systems Atomizing Nozzle

obtained with the Atomizing Spray Nozzle is of the hollow cone type with uniform distribution and perfect atomization. The standard stock construction is brass with stainless steel inserts; however, other metals can be specified.

The Atomizing Spray Nozzle is of sturdy construction and is now available in male or female ¼ in. pipe connections with or without a strainer. The capacities of the unit range from 1 to 14 g.p.h. at 40 pounds pressure.

Thermoil-Granodine

A protection for iron and steel machine parts against friction and corrosion, to be known as "Thermoil-Granodine," has been placed on the market by American Chemical Paint Company, Ambler, Pa. This type of finish can be applied to items such as piston rings, pistons, valve tappets, axles, gears, clips, screws, locks, and so on. This type of finish is said to be easy to apply in large and small scale production for providing a wear and rust resistant surface on iron and steel.

When iron or steel parts are to be treated with Thermoil-Granodine, they must first be cleaned. The cleaning can be done by using a spirit solvent, or a solvent vapor, or an alkaline solution followed by a water rinse. This treatment prepares the parts for immersion in a boiling solution of Thermoil-Granodine. Here they remain for a time varying from 10 minutes to an hour, during which time the surface of each part becomes an even layer of iron and manganese phosphates.

After the Thermoil-Granodine bath, the parts are rinsed in hot water and

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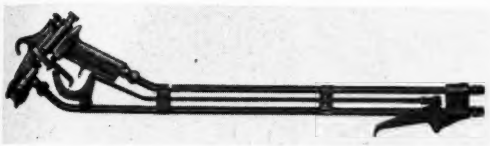
then dried. An ordinary steel tank may be used for the boiling Thermoil-Granodine. Thermoil-Granodine is available in gallons, kegs and barrels.

DeVilbiss Extension Handle

An extension handle which adapts the DeVilbiss Heavy-Duty High-Speed MBC Spray Gun to extension spray painting has been placed on the market by The DeVilbiss Company, 300 Phillips Ave., Toledo, Ohio. The handle is designed to combine the convenience of an extension gun for many classes of work in industrial painting.



DeVilbiss Extension Handle

The DeVilbiss Extension Handle is light in weight and properly balanced. Location and construction of the trigger are such as to make operation as simple as with the gun itself.

The nozzle of the gun is tilted at a 40 deg. angle from the line of the handle. This is said to facilitate spray coating of jobs which are difficult to paint with a gun alone. The extension is rigidly constructed of air and fluid tubes, held by clamps and soldered into a strong casting at the inlet end. The extension handle trigger is attached to this casting and operates the gun by means of a simple ball crank system.

The DeVilbiss Extension Handle has the same combination of air and fluid connections as are available with the Type MBC gun and may be attached or removed in a minimum of time. The extension handle is available in lengths of 3, 4, 5, 6, 8 and 10 feet. The 8 and 10 foot lengths are specially reinforced.

Faratron Liquid Level Control

A liquid level control to be known as "Faratron" has been placed on the market by Lumenite Electric Co., 408 S. Dearborn St., Chicago, Ill. The Faratron Liquid Level Control equipment consists of one or more metal electrodes positioned vertically in an open or closed container connected to act as antennae in an electronic circuit originating at a control housing. This housing can be located in any desired position to a maximum distance of 125 ft. from the electrodes.

The equipment encloses a standard electronic amplifying tube, power relay with connection and terminals for power input, the electronic circuit power output to a magnetic starter or solenoid - operated equipment. Power equipment is standard at 110-volt, 60-cycle alternating current.

The electronic circuit carries approximately 1/10 milliampere at 1 millivolt. The circuit-operated relay is rated at 1 h.p. on 110-volt, 60-cycle alternating current. Connection can be made to operate a pump motor, open or close a line valve or gate, and sound or flash signals as the material in the tank rises and falls in relation to a predetermined level and clears or contacts the electronic field set up in the electrodes.

Each electrode is mounted in an insulated position to extend down vertically into the container. The electrode is made of metal, and can be encased in glass or painted, enameled, plated or left bare without affecting its operation which is permanently set in relation with the specified type of materials whose level is to be controlled. The electrode can be specified for use with corrosive or non-corrosive materials and according to the manufacturer, will not contaminate the material being controlled.

Various arrangements of one or more electrodes and automatic control housing assembly are available.

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KEYSTONE EMERY MILLS *Write for Sample* 4316 Paul St., Phila., Pa.

Shelburne Twin Hose

A hose with twin passages for paint and air has been placed on the market by A. Shelburne Company, 739 Series Ave., Los Angeles, Calif. The twin hose is said to consist of a $\frac{5}{8}$ in. passage for paint and a $\frac{1}{8}$ in. passage for compressed air in a pair of tubes joined along their length by a web to make a single unit.

A two-braid molded construction is employed, using Neoprene synthetic rubber on the paint side, and with smooth black rubber on the casing. Smooth red rubber is used on the air side.

The standard lengths available are 12½, 25 and 50 feet. Couplings are available to specification to fit a variety of paint guns.

Rust-Prime

A paint primer which can be used under paint on rusted metal surfaces, to be known as "Rust-Prime," has been placed on the market by Skybryte Company, 3125 Perkins Ave., Cleveland, Ohio. The action of Rust-Prime is said to neutralize the rust and form a plastic bond under a finishing coat. The average coverage is 650 sq. ft. per gallon and the application can be made either by brushing or spraying.

Munn Insulating Refractory

Standard brick shapes for service at 2,000 deg. F. have been placed on the market by Munn & Steel, Inc., 500 Fifth Ave., New York, N. Y. This brick is a machine-mixed, and hand-molded material. It is said to resist spalling and oxidation. The average weight of each brick is 25 ounces.

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1518 E. Genesee Ave., Saginaw, Michigan

Hammond Type R Polishing and Buffing Lathe

Hammond Machinery Builders, Inc., 1601 Douglas Ave., Kalamazoo, Mich.

Hammond Type R Polishing and Buffing Lathe

has recently placed on the market a polishing and buffing lathe, to be known as the "Type R." The spindle of this lathe is 45 in. long and operates on two high-grade ball bearings. It is driven by V-belts from the motor which is mounted inside the base of the unit.

Standard equipment includes push-button control with a starter which has an overload and low voltage protector. The spindle can be locked when changing wheels.

The Type R Polishing and Buffing Lathe weighs 475 pounds.

Pangborn Airblast Helmet

A helmet which is designed to rest upon the shoulders of sand and shot blast operators, to be known as the "DD-4" Airblast, has been placed on the market by Pangborn Corporation, Hagerstown, Md. This helmet is designed in such a manner as to receive a continuous supply of respirable air. The wearer breathes the supplied air, rather than the air in the immediate vicinity. A detachable coupling in the air line is available within easy reach of the operator.

Crown Type DN Air Duster

The Type DN Air Duster, which can be adapted for blowing, cleaning and dusting operations in industrial finishing rooms, has been placed on the market by Crown Spray Gun Manufacturing Co.,

Crown Type DN Air Duster

1218 Venice Blvd., Los Angeles, Calif. This unit, as shown in the illustration herewith, is ruggedly constructed and of a size that will fit comfortably into the palm of the hand. The valve seat is made of Thiokol, a feature which is said to afford long, leak-proof life of the unit.

The Crown Type DN Air Duster is nickel plated and is equipped with ¼ in. air inlet thread and can be furnished with ⅜ in. or 9/16-20 in. thread.

Curran Hydralene

A cleaning material supplied for solution in kerosene and petroleum distillates, to be known as "Hydralene," has been placed on the market by Curran Corporation, Curran St., Malden, Mass. This material is said to differ from the Curran Gunk compound in that it is said to be odorless. Hydralene is available in 8 pound cans, 40 pound pails, 225 and 400 pound drums.

Baer Acid and Water-Proof Paint

Baer Brothers, 444 West 37th St., New York, N. Y., has just placed on the market a chemical, acid and water-proof paint. The manufacturer recommends this paint as an ideal finish for protecting metal from the effects of most alkalies and acids, as well as from fumes and steam from various processes.

The new paint is said to be excellent for general factory maintenance on both exterior and interior exposures. It can readily be applied on machinery, pipe lines or any other type of equipment by either brush or spray application. It is furnished in any color or shade.

No-Rust Liquid V-15

A formulation of an anti-rust preparation, to be known as "No-Rust Liquid V-15," has been developed and is now being marketed by Frost Paint & Oil Corp., 1209 N. E. Tyler, Minneapolis, Minn. This product is recommended for protecting polishing steel parts of machinery and tools against rust in storage and during shipment.

No-Rust Liquid V-15 is easily applied with a brush or spray gun, and requires no mixing or special preparation. It dries in 30 minutes to form a tough, elastic, non-porous film which resists abrasion, moisture and salt air. The protective coating is readily removed by wiping with gasoline or kerosene when the machine is placed in service.

G. E. 100-Watt Fluorescent Lamps

Out of the laboratory which produced the 100-watt high efficiency bulb-type mercury lamp comes a new light source for general industrial lighting, a 100-watt fluorescent lamp. Developed by the General Electric Vapor Lamp Company, 897 Adams St., Hoboken, N. J., to supplement its line of industrial lighting units such as the long-tube Cooper Hewitt lamp, the new lamp is a tubular light source, 4-ft. in effective length.

The lamp derives its terminology "fluorescent" from its utilization of a special high efficiency fluorescent material as

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the inside coating of the tube. Ultra violet radiations produced in the tube are converted by this coating to visible light by means of a high ratio energy transformation. The rated life of the fluorescent lamp will compare favorably

G. E. 100-Watt Fluorescent Lamp for Industry

with that of other industrial light sources.

Probably the most outstanding feature of these lamps, resulting from use of the phenomenon of fluorescence, is their high efficiency. Contrasting with the 100-watt bulb-type mercury lamp, for example, whose initial efficiency is 35 lumens per watt (more than twice that of incandescent lamps of the same wattage), the efficiency of the 100-watt fluorescent lamp is 50 lumens per watt. or, according to the manufacturer, three times that of equivalent wattage incandescent light sources.

The new lamp is a result of three years of exhaustive laboratory research by the General Electric Vapor Lamp Company, which has advocated tube light sources for over 35 years, paving the way to the development of the fluorescent tube light source in this country. The 100-watt fluorescent lamp is expected to find application in industry as an extension of this company's line of high output tubular light sources.

Densoxcide

A rustproofing material which is said to provide a flexible film over metal surfaces, to be known as "Densoxcide," has been placed on the market by Densol Paint Co., 7840 Rockside Rd., South Park, Ohio. This material is compounded for application on exterior or interior metal surfaces. It can be applied after light wire brushing or scraping of a rusted surface. It is said to aid in prohibiting further corrosion whenever it is applied.

The Densoxcide remains slightly pliable after application and provides a good base for final application for elastic finishing material.

Pyroxylin Undercoat

A new pyroxylin undercoat for automotive refinishing, designed especially for use under automotive Pyralux, has been placed on the market by E. I. Du Pont de Nemours & Company, Inc., Wilmington, Del. The purpose of the undercoat is to prevent "sinking in" and to aid in obtaining a uniform gloss.

The pyroxylin undercoat is a light gray in color and is available in quart, gallon, and five-gallon cans.

BOOKS

Toxicity of Industrial Organic Solvents

Many volatile substances now used in industry may have injurious effects

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THE STAINLESS STEEL BUFFING COMPOSITION
BUCKINGHAM PRODUCTS COMPANY
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upon the health of workers using them. The number of such substances is increasing. As adverse effects upon the health of workers may also occur after a long period of exposure to dilute concentrations of substances which are poisonous in high concentrations there is need for research in order to find out the actual toxic effects of each substance under any conditions likely to bet met with in industry.

As a first step, it has been necessary to collect the information already available. This has now been done for the Industrial Health Research Board by Dr. Ethel Browning. The chapters review the following main groups of chemicals: The Hydrocarbon Group, The Chloro Compounds, The Alcohols, The Esters, The Cyclohexane, Derivatives, The Ketones, The Glycol Group, and Miscellaneous including Carbon Bisulphide, Pyridine and Ethyl Ether.

The wide range of information collected for the first time in this work will obviously be of all the greatest value to works chemists and to all those in charge of industrial processes using chemical materials likely to damage the health of their workers.

The price of this first American edition is $3.50 and may be obtained by writing to the Chemical Publishing Co. of N. Y., Inc., 148 Lafayette St., New York, New York.

"Young Unit Heater Catalog No. 2738." This is the title of a 16-page catalog which is now being distributed by Young Radiator Company, Racine, Wis. This catalog is well illustrated with photographs of actual installations and specifications of installations in finishing departments and industrial plants of all kinds.

Young "Streamaire" Unit Heaters have been carefully designed with respect to appearance, quietness in operation, strength and performance. Special die equipment was made to form the casings of these unit heaters. All corners and edges are made with a large radius. The entire casing, made of furniture steel, is thoroughly braced and welded together giving strength and rigidity and eliminating objectionable noises and rattles.

Slow speed, quiet operating motors, designed for unit heater service are used on all units. The fans have been selected with particular attention being paid to large air deliveries with quiet operation and minimum power requirements. All motor mountings are rubber insulated to prevent any motor vibration being transmitted to other parts of the unit. The heating elements are also insulated from the casings with heat resisting, sound deadening material. Louvers that are individually adjustable are located on the front of each unit so that the distribution of air can be properly regulated.

The heating elements that are used in Young Streamaire Unit Heaters are made from pure copper seamless tubing metallically bonded to pure copper fins. Special close grained one-piece cast iron headers are used on all heating elements. The copper tubes are rolled into these headers with boiler tube construction, all joints being further reinforced with ferrules. The heating elements are supported in the casings by a special spring suspension to eliminate any dangers from expansion and contraction. Capacity tables for Young Streamaire Unit Heaters are also listed in Catalog No. 2738. There is a large variety of sizes available so that units can be selected for use for practically any type of installation. Copy of "Young Unit Heater Catalog No. 2738" will be sent free upon request.

Viscosity Tubes. The air bubble method for determining viscosity or body of varnishes and lacquers, and the equipment necessary for this test are described in detail in a new 8-page folder entitled "Viscosity Tubes" which is now being issued by R. P. Cargille, 118 Liberty St., New York, N. Y.

This folder discusses in detail the background of the test, the advantages of the bubble method of determining

Borolon TRADE MARK ABRASIVE POLISHING GRAIN
Strictly first quality aluminum oxide abrasive grain manufactured in our own electric furnace plant. Specially prepared and treated for most efficient polishing performance. Write for samples.
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viscosity and the relationship of the speed of the bubble to the tolerance with which the inside diameters are matched. A number of other laboratory devices of interest to chemists as well as paint and varnish workers are also included.

Copy free upon request.

Handbook of Localized Lighting. The Fostoria Pressed Steel Corp., Fostoria, Ohio, is now issuing a 24-page catalog entitled "Handbook of Localized Lighting." This book endeavors to place localized lighting in its proper relationship to general lighting, and outlines the need for supplementing lighting in many production, assembly and inspection operations.

A total of 700 distinct units in the Fostoria line indicates the extent of Localite progress during the past three years. Models range from small units using 6-8 volt lamps up to 120-inch canopy units using four 150-watt lamps. Many of the units are classified as flexible arm models.

Copies will be sent free upon request.

"Greater Industrial Safety." This is the title of a 12-page catalog which stresses ways in which modern cleaning methods and materials provide increased safety for plant, product and personnel which is now being issued by Oakite Products, Inc., 20 Thames St., New York, N. Y.

The catalog concisely reviews effective ways to eliminate fire hazards and fire hazardous conditions and is designed to act as a guide to point out many industrial maintenance operations where safety is an essential factor. Also discussed in this catalog are certain well-known occupational hazards and the safeguarding of health through proper plant maintenance practice. Copy free upon request.

"Tag Indicating, Recording and Controlling Instruments for Temperature and Pressure." This is the title of a 64-page catalog which is now being issued by C. G. Tagliabue Mfg. Co., Park and Nostrand Aves., Brooklyn, N. Y. It is more than a regular listing catalog for it presents information in a clear, understandable way regarding the latest Tag instrument developments.

In addition to the new line of recording thermometers and recording pressure gages with 10 to 12 inch charts, complete data is included on indicating and recording controllers. The control instruments are listed in either the "on-off" model for all ordinary control applications, or the throttling model for use where any considerable apparatus is encountered.

Many illustrations show not only how these pressure-spring instruments operate, but the practical installation photographs tell an interesting story of what they are doing for the process industries. A copy will be sent free upon request.

Black & Decker Catalog.— The 1939 Black & Decker catalog, which is now being issued by The Black & Decker Mfg. Co., Towson, Md., features a complete line of portable electric tools and accessories. This catalog comprises 56 pages plus cover, attractively displaying the Black & Decker line. Many new improvements in design and construction have been incorporated into many of the familiar units in the line and a number of new tools have been added to conform with the company's policy to keep abreast of market requirements.

Particular attention is called to three new units making their appearance for

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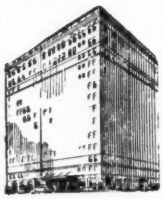
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the first time in this catalog. On page 1, a new ¼ in. hornet drill is illustrated and described. On page 5, is the new ¼ in. ball bearing utility drill and on page 29, is the new No. 36 portable electric hammer.

These three new tools, together with the Holgun and Scrugun and other tools announced during the year, are said to give the most complete and up-to-date line that Black & Decker has ever offered.

Copy of this catalog will be sent free upon request.

"Falstrom Engineered Industrial Ovens and Dryers." This is the title of a four-page folder which is now being issued by Falstrom Company, Passaic, N. J. Four types of ovens are described in this folder, namely: truck, belt conveyor, monorail and loop type ovens.

One of the features of the Falstrom oven is positive heat placement by Falstrom controlled air recirculation in temperature recording and control equipment where necessary. Due to the use of efficient insulating materials, there is a minimum of heat loss. The wall construction features are said to give minimum metal-to-metal contact.

Heat conservation is effected by Falstrom controlled air recirculation in which the air recirculated may be partial or complete. The Falstrom type ovens are of panel construction, consequently they can be easily erected, moved or enlarged.

An improved door closing mechanism requires no slamming and no pushing and at the same time effects three-point locking. Copy free upon request.

"Chemicals by Glyco." This is the title of the latest catalog which has been issued by Glyco Products Co., Inc., 148 Lafayette St., New York, N. Y. A complete index of products, formulae, and uses is said to make it very easy for chemists and technical workers to find any particular piece of information they are looking for. A number of new products are also described in this catalog in addition to a complete line of esters, emulsifying agents, synthetic waxes, resins, and so on. Copy free upon request.

Brown Instrument Folder No. G-37.—The Brown Instrument Company, Wayne and Roberts Aves., Philadelphia, Pa., is now issuing a new folder illustrating its complete line of indicating, recording and controlling instruments for measuring and controlling temperatures, pressures, flows, liquid levels and humidity.

A brief description under each illustration includes information on models and operating features.

Typical Brown installations are shown. A copy of Folder No. G-37 will be sent free upon request.

"How Air is Being Used in Your Industry." This 26-page booklet comprises, in effect, a survey of the practical, time and money-saving uses of compressed air in all types of industries. The jobs listed are practical applications which are regularly being made in plants where costly hand labor and hand equipment is being replaced with modern handling devices. The book also contains a number of condensed reports on the uses of Curtis air hoists and cranes in a variety of industries. Copy free by addressing Curtis Pneumatic Machinery Co., St. Louis, Missouri.

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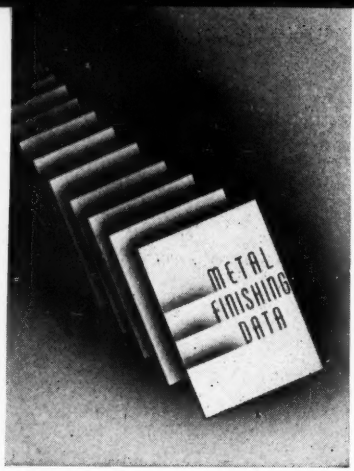

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To obtain copies of the catalogs listed here, indicate on the coupon the number of the item in which you are interested and mail as directed.

1. Dust Collecting System
Complete information regarding the application of the Roto-Clone for eliminating dust problems. American Air Filter Company, Inc., 142 Central Ave., Louisville, Ky. See page 21.

2. Chemicals
The McGean Chemical Co., Cleveland, Ohio, has issued a 24-page catalog for users of chemical products containing a comprehensive list of the staple items manufactured and carried in stock.

3. Industrial Ovens
Two new bulletins giving full particulars on air heaters and industrial ovens. J. O. Ross Engineering Corporation, 350 Madison Ave., New York, N. Y. See Third Cover.

4. Filter Presses
A folder completely illustrating and describing the new Miller filter press, giving industrial applications and engineering features is being issued by the J. C. Miller Co., 55 Mt. Vernon Ave., N. W., Grand Rapids, Mich. The Miller diaphragm pump is also illustrated and described.

5. Miecro Supreme Stop-Off Lacquers
A 4-page folder describing stop-off lacquers for insulating plating racks used in decorative plating and for masking parts to be hard chromium plated now being issued by Michigan Chrome Company, 6342 E. Jefferson Ave., Detroit, Mich. See page 11.

6. Plating Barrel
The Udylite Plating Barrel is completely detailed in a bulletin published by the Udylite Company, 1651 E. Grand Blvd., Detroit, Mich. See page 3.

7. Industrial Ovens
A method whereby oven costs can be reduced, the production improved and oven operations accelerated is described in the 4-page catalog now being issued by The Kirk & Blum Manufacturing Co. 2816 Spring Grove Ave., Cincinnati, Ohio. See page 23.

8. Spray Booths and Ovens
Newcomb-David Company, Inc., 5741 Russell St., Detroit, Mich., has issued a 24-page catalog illustrating and describing typical N-D Spray Booths, Industrial Ovens, Metal Booths, Washers and Ventilating Equipment.

9. Sulfuric Acid vs. Metals
A detailed technical bulletin dealing with the corrosive action of various concentrations of sulfuric acid on metals. The International Nickel Company, Inc., 73 Wall St., New York, N. Y. See page 6.

10. Technical Information on Monel, Nickel and Nickel Alloys
The properties and uses of Inconel are

concisely described in this catalog which is now being issued by the Development and Research Division, The International Nickel Company, Inc., 67 Wall St., New York, N. Y.

11. Metal Cleaning Hints
An interesting bulletin giving details on Metalprep Rust and Grease Remover. Tells how Metalprep makes metals safe for paint. Neilson Chemical Co., 6564 Benton St., Detroit, Mich. See page 55.

12. Automatic Polishing Machines
The Packer Machine Co., Meriden, Conn., has issued a catalog illustrating and describing the Packer line of automatic polishing and buffing machines.

13. Parker Processes
Parker Rust-Proof Company, 2172 East Milwaukee Ave., Detroit, Mich., is now issuing a new booklet describing various applications of their unique processes of Parkerizing and Bonderizing, their rust preventive processes. This very attractive two-color booklet describes these two processes and cites many instances when they have solved the rust preventive problem.

14. Tumbling Equipment
A new bulletin giving information on tumbling equipment and tumbling compounds for metal-finishing in mass production. Lupomatic Tumbling Machine Co., Inc., 4510 Bullard Ave., New York, N. Y. See page 81.

15. Metallic Coatings
A folder, together with samples of Hilo Metallic Rip-pls which are said to give wave line effects and a metallic sheen in one coat. Hilo Varnish Corporation, 42-60 Stewart Avenue, Brooklyn, New York.

16. Satin-Black Penetrating Finish
A 4-page folder describing Pentrate, a penetrating process paint which provides a means of applying an attractive, low-cost black finish to steel through chemical action. Heatbath Corporation, Springfield, Massachusetts.

17. Viscosity Tubes
An 8-page folder describing the air bubble method for determining the viscosity or body of varnishes and lacquers and the equipment necessary for this type of test. R. P. Cargille, 118 Liberty St., New York, N. Y. See page 61.

18. Finishing Department Maintenance
A 4-page folder describing the manner in which the use of Arco paint in maintenance work aids in efficient maintenance painting. The Arco Company, 7301 Bessemer Ave., Cleveland, Ohio.

19. Portable Electric Tools
One of the most complete catalogs on Skilsaw Portable Electric Tools for production, maintenance, and construction. Skilsaw Inc., 5033 Elston Ave., Chicago, Ill. See page 47.

20. Reference List of ACP Products
A 4-page folder which can be used as a handy reference table of chemicals and processes marketed by American Chemical Paint Company, Ambler. Pa. See page 25.

Print plainly in filling out coupon for literature.

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